

The Challenge of Climate Change

Presidential Management Fellows (PMF) Forum
27 July 2007

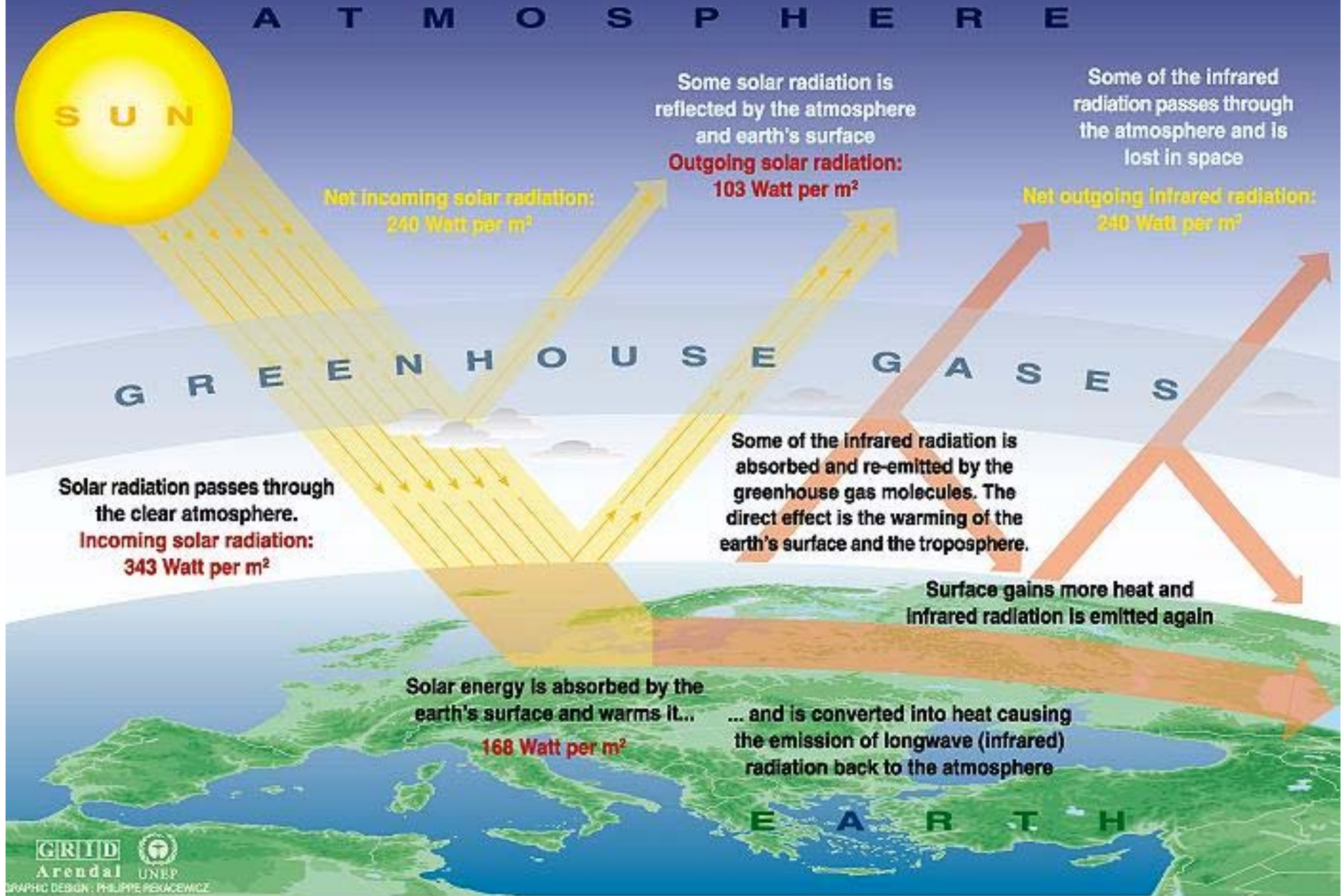


Rob Bradley

World Resources Institute

<http://www.wri.org>

The Greenhouse effect



IPCC, February 2007

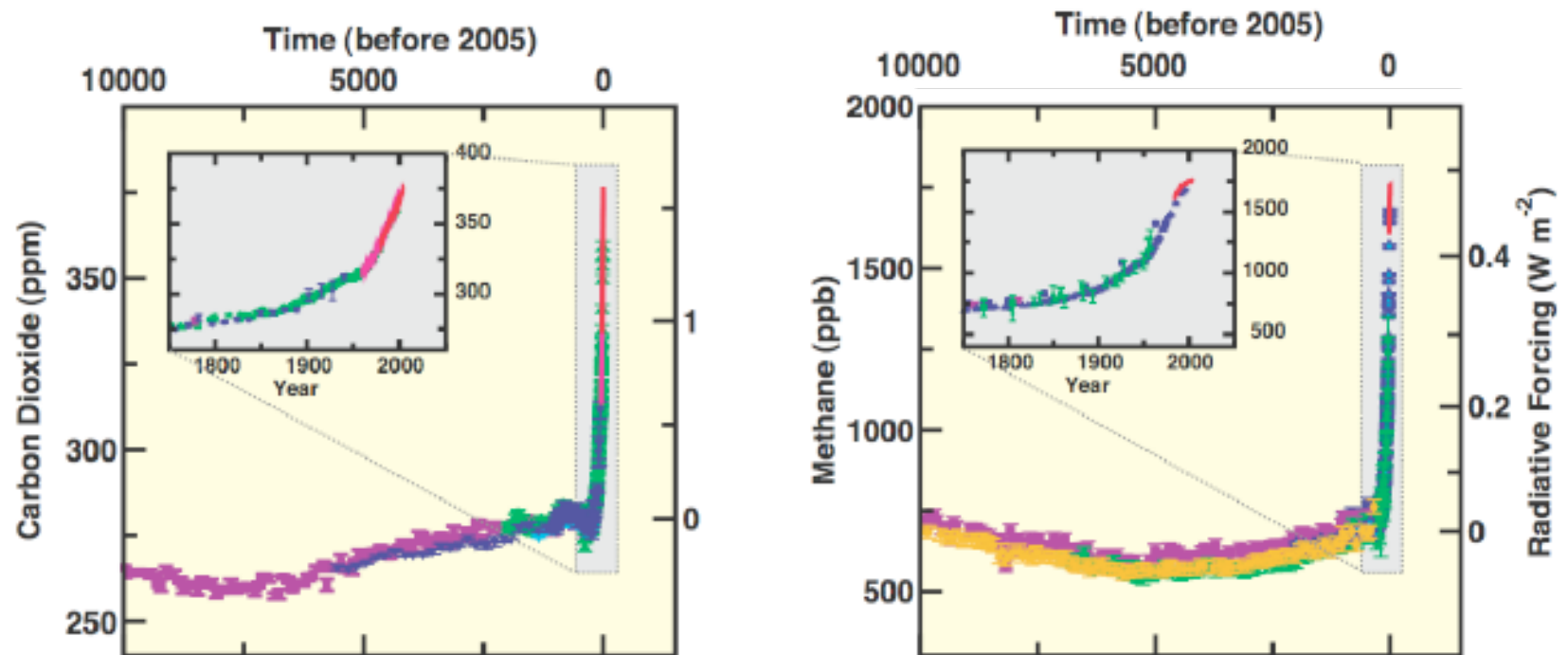
The IPCC has “*very high confidence* that the globally averaged net effect of human activities since 1750 has been one of warming...”

“[I]ts rate of increase during the industrial era is *very likely* to have been unprecedented in more than 10,000 years.”

NOTE: *very high / very likely* implies greater than 90% confidence



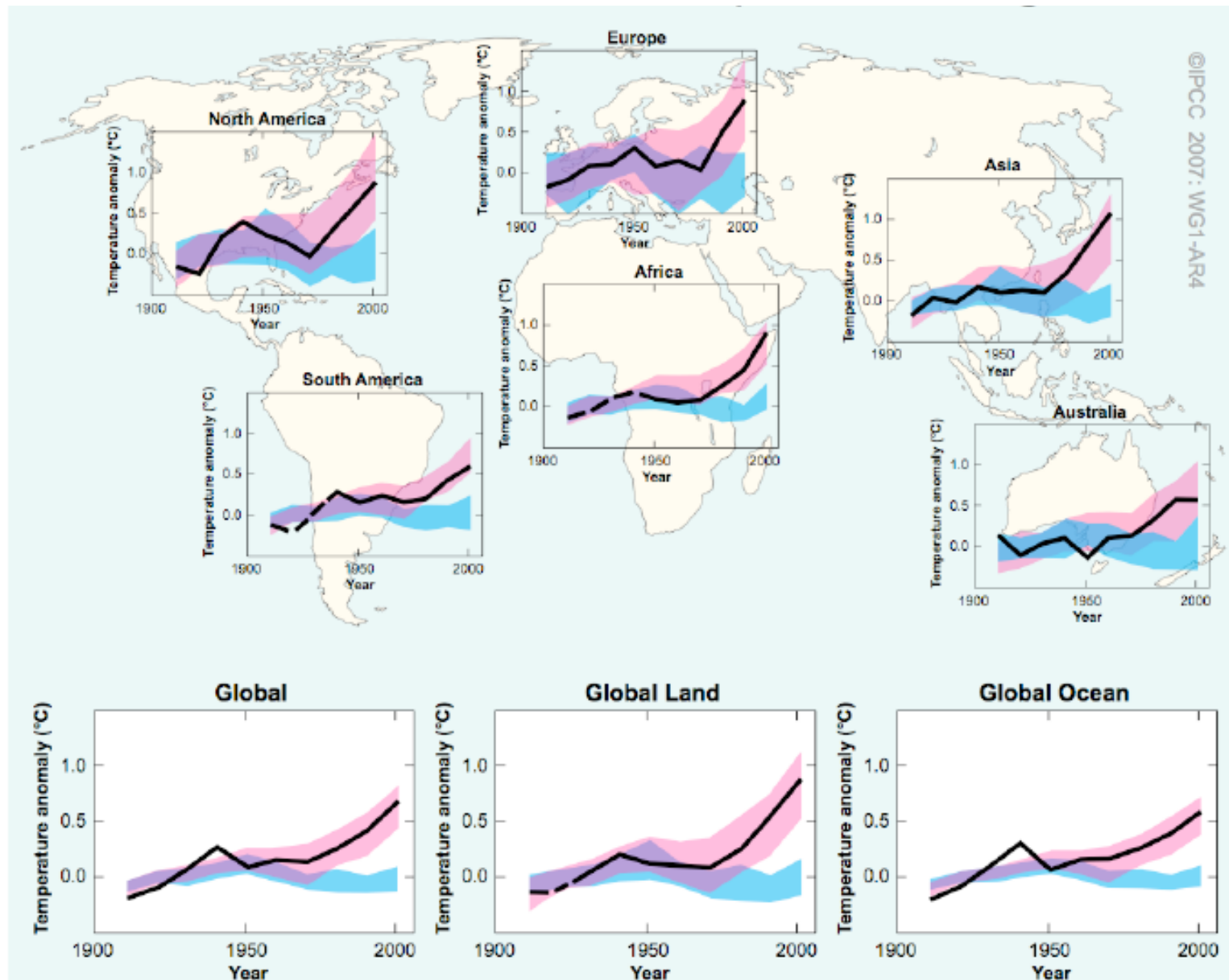
Change in GHG Concentrations



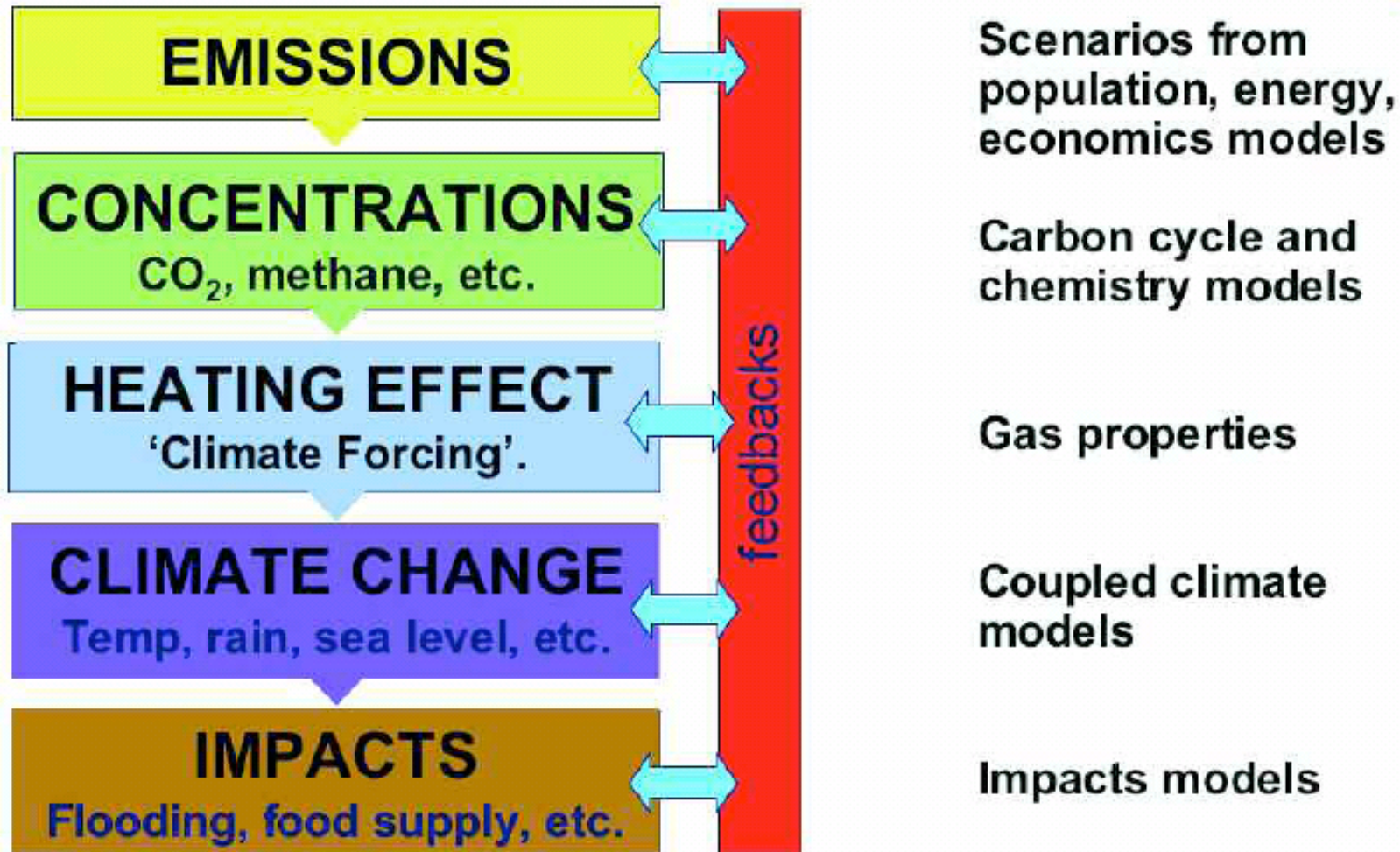
Source: IPCC, 2007



Global Temperature Changes



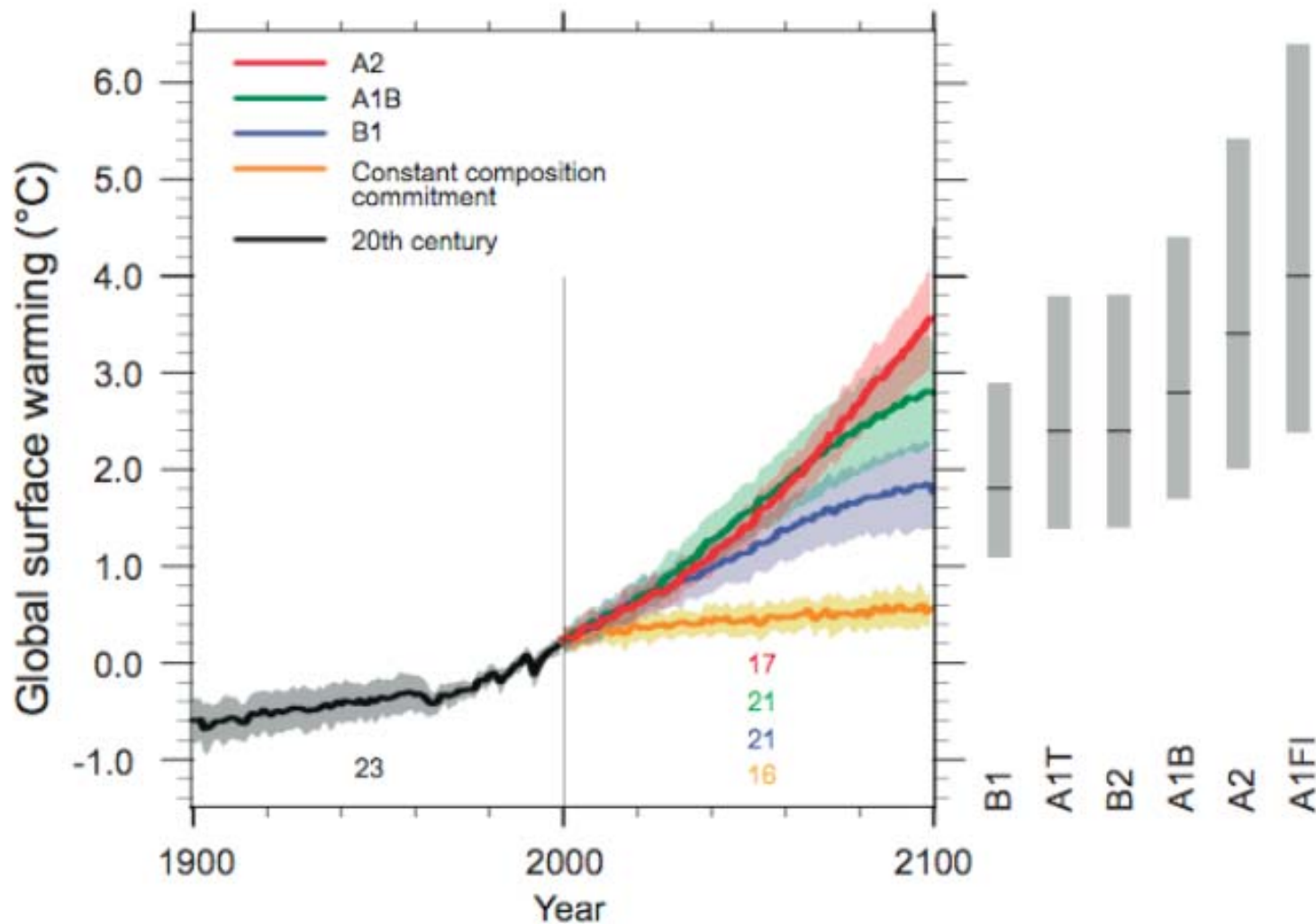
Projecting Climate Change



Source: UK Hadley Center, 2007



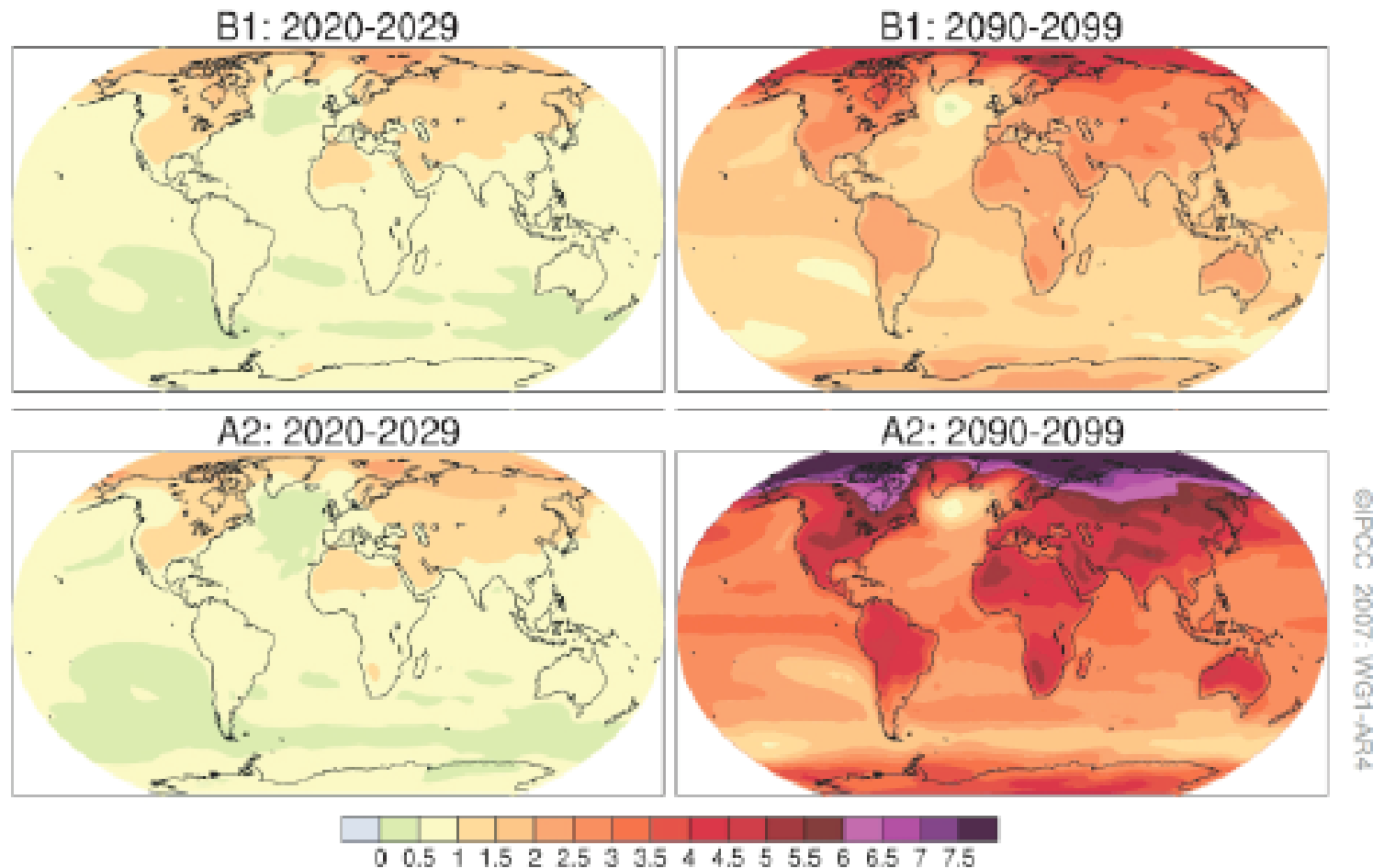
Projected future temperature



Source: IPCC, 2007



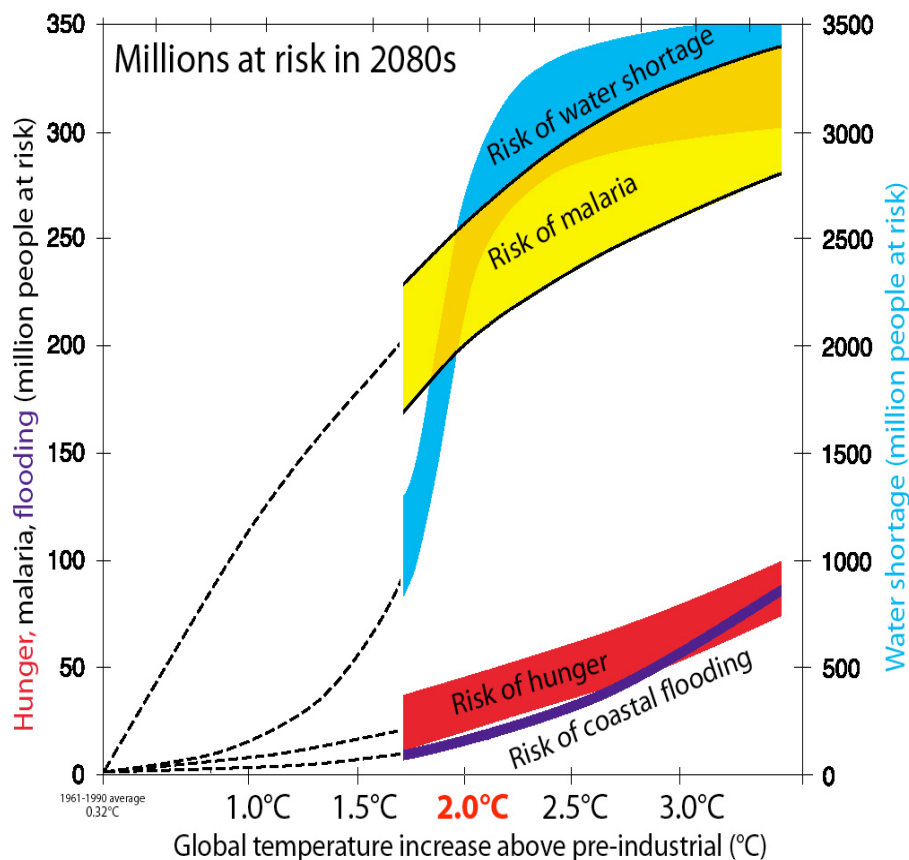
Projections of Surface Temperature



Source: IPCC, 2007



Risks from Global Warming

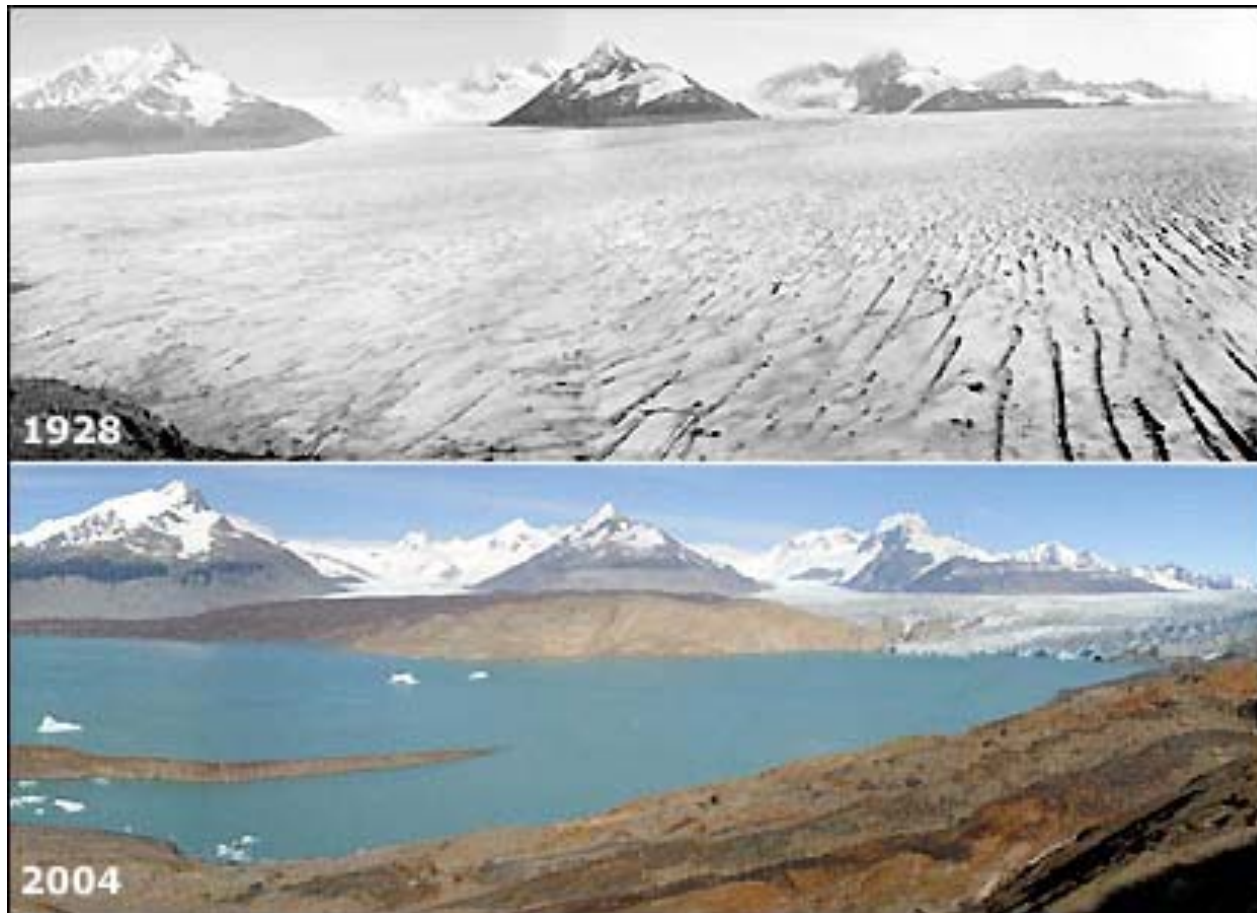


Source: Parry (2001), and IPCC WG 2, April 2007

- Water shortages harm up to 250 million in Africa by 2020
- Certain agriculture yields in Africa may fall 50% by 2050
- Decreased availability of fresh water in Asia might effect more than a billion people by 2050.
- Some areas of Europe are projected to lose up to 60% of their species by 2080.
- The Americas will see reduced snowpacks, leading to water supply problems by 2020

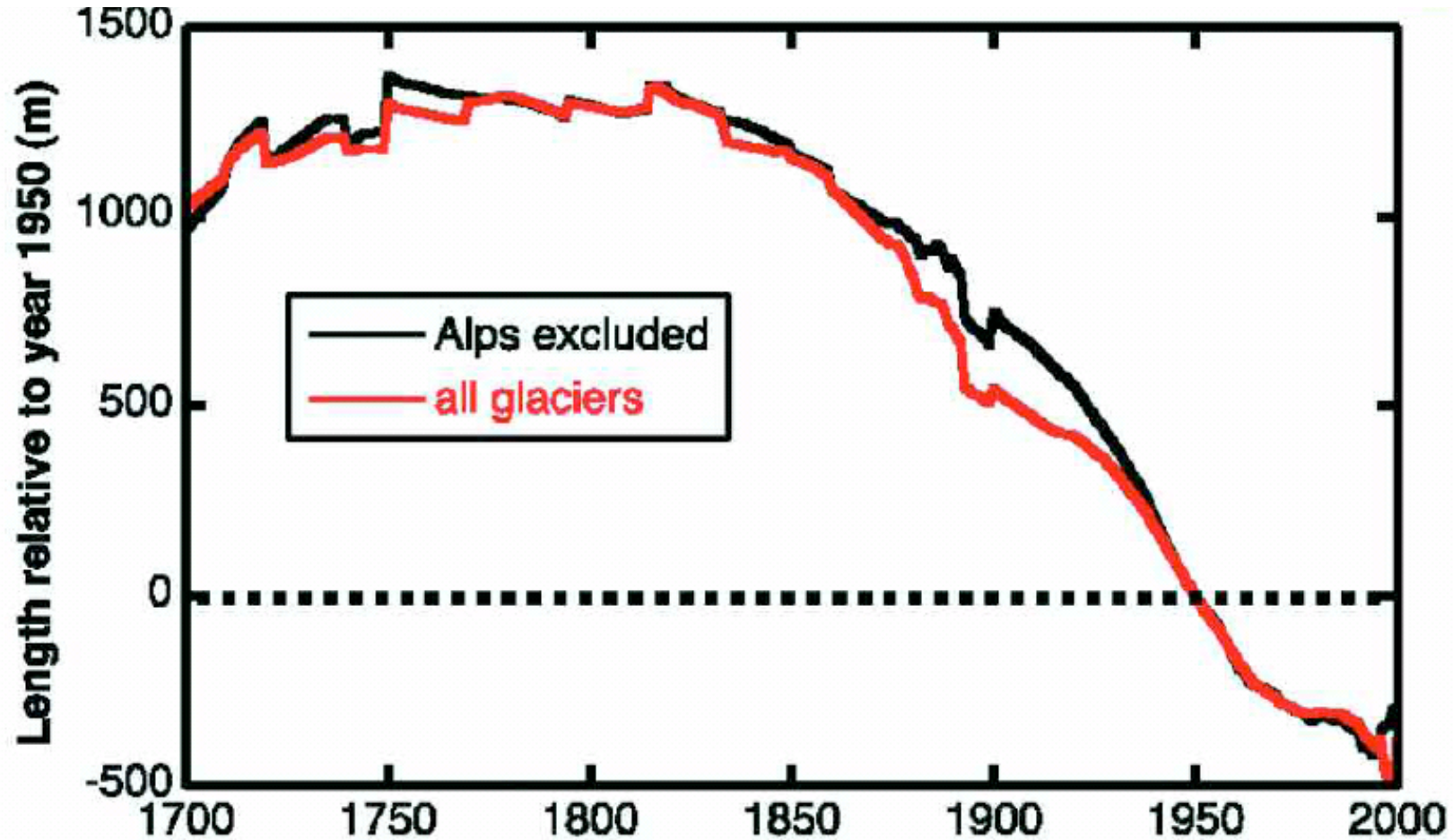


Andean Glaciers



Source: http://news.bbc.co.uk/1/shared/spl/hi/picture_gallery/05/sci_nat_how_the_world_is_changing/html/1.stm

Global Glacier Retreat

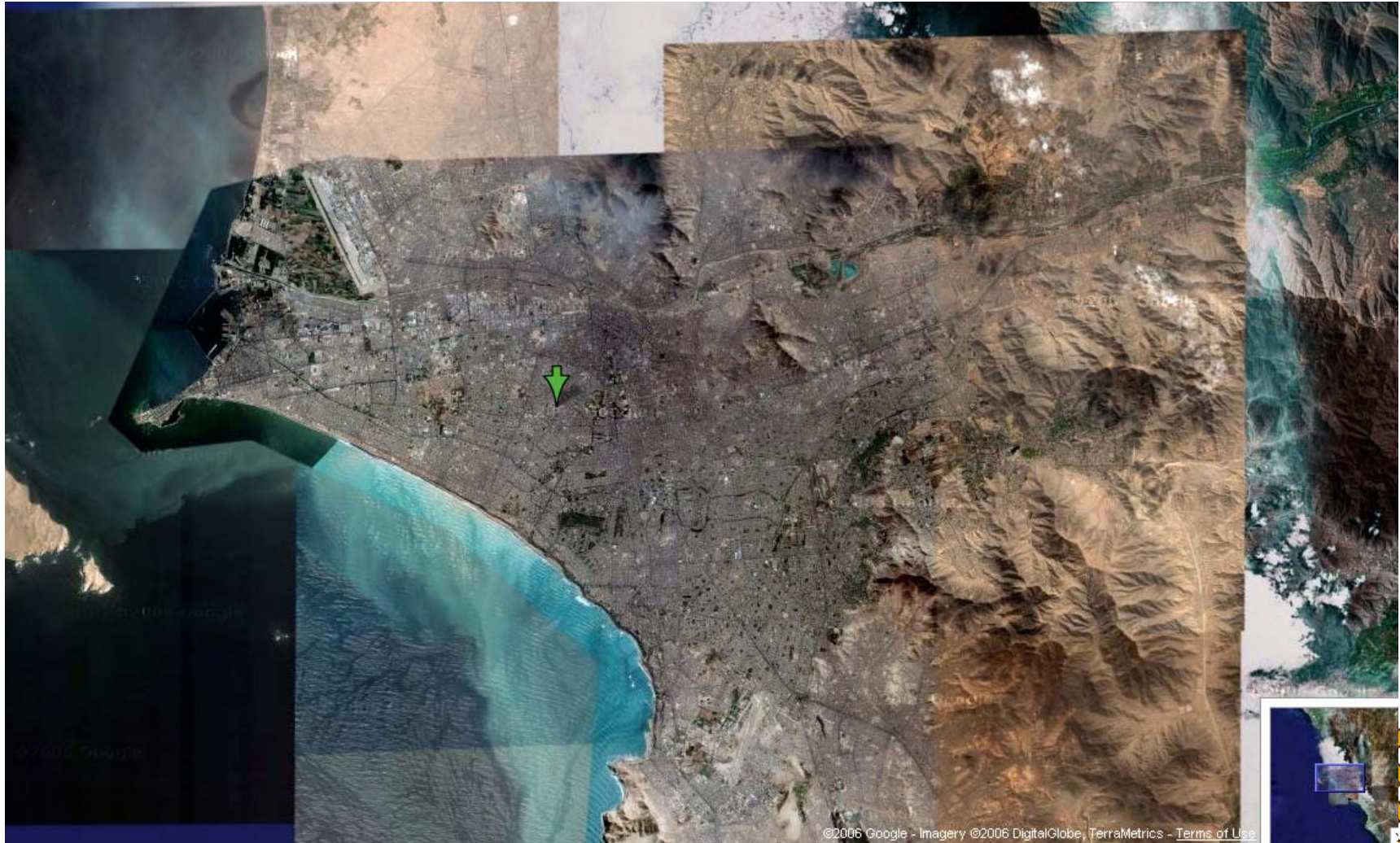


Oerlemans, H. Extracting a climate signal from 169 glacier records.
Science 308 675–677 (2005).

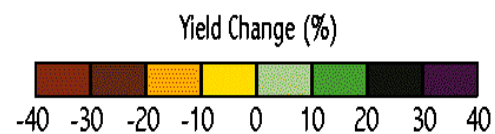
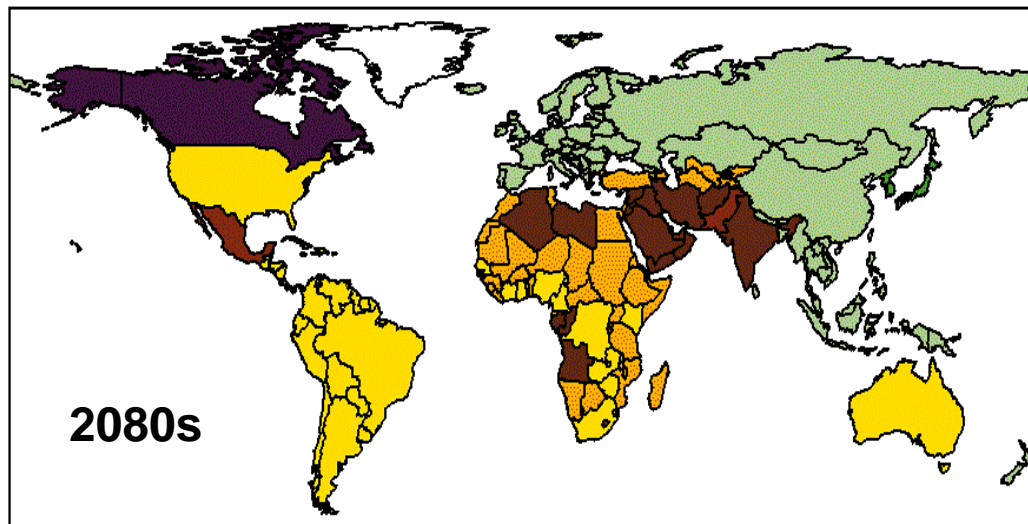
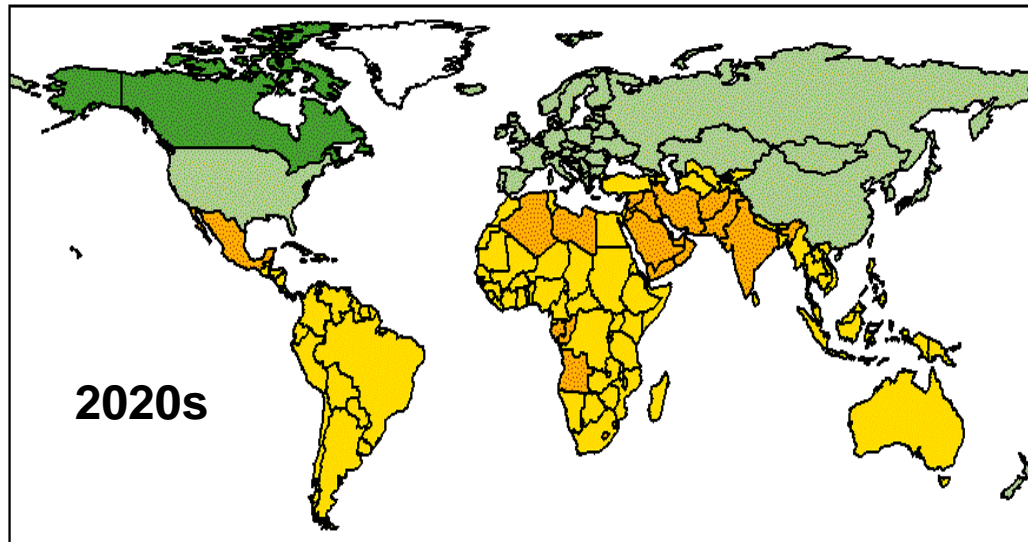


Lima, Peru

(population ~7 million, 50 mm/yr rainfall)



W R I



Crop Yield Change

Source: IPCC TAR



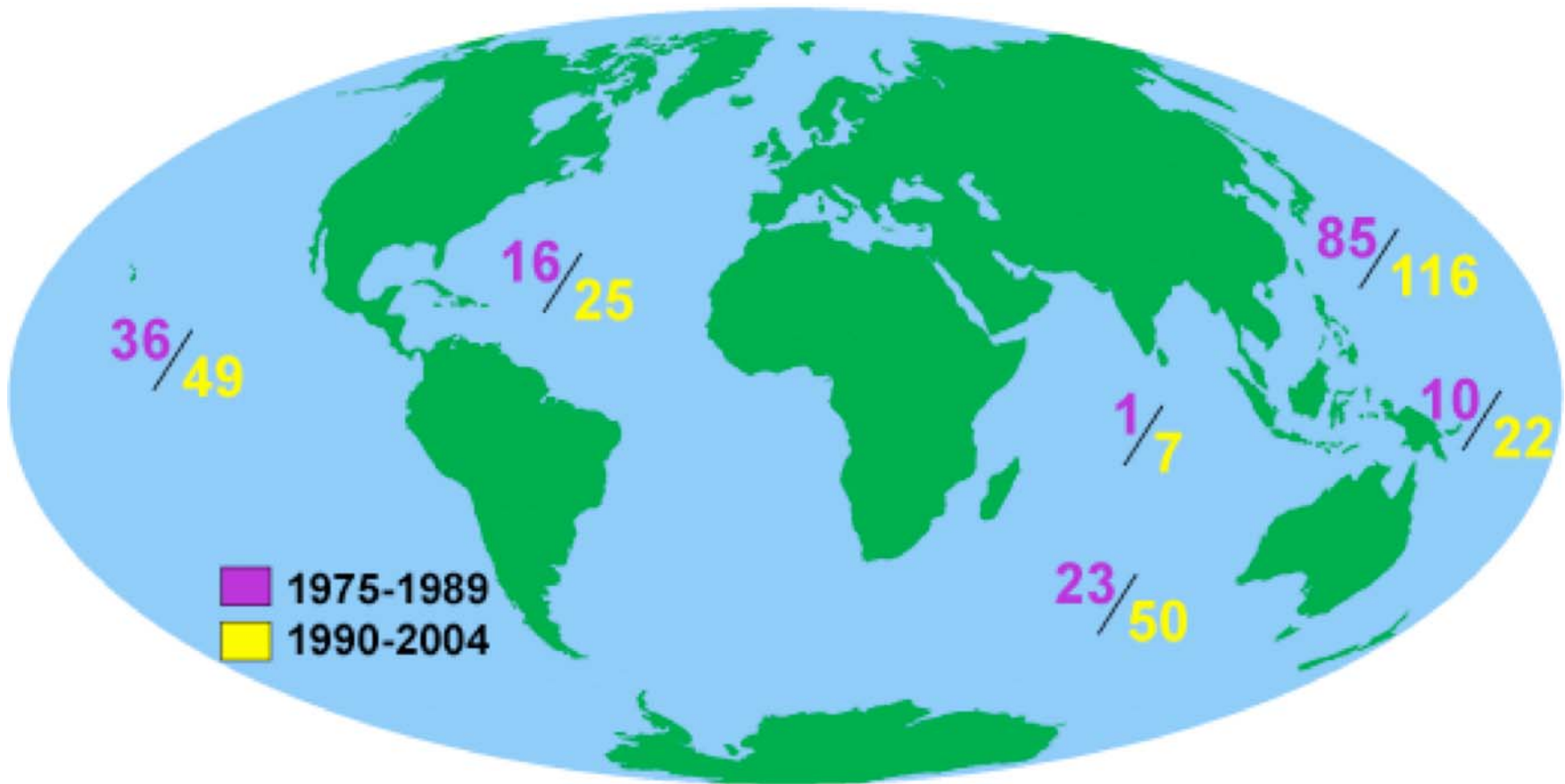
New Patterns of Pest Damage



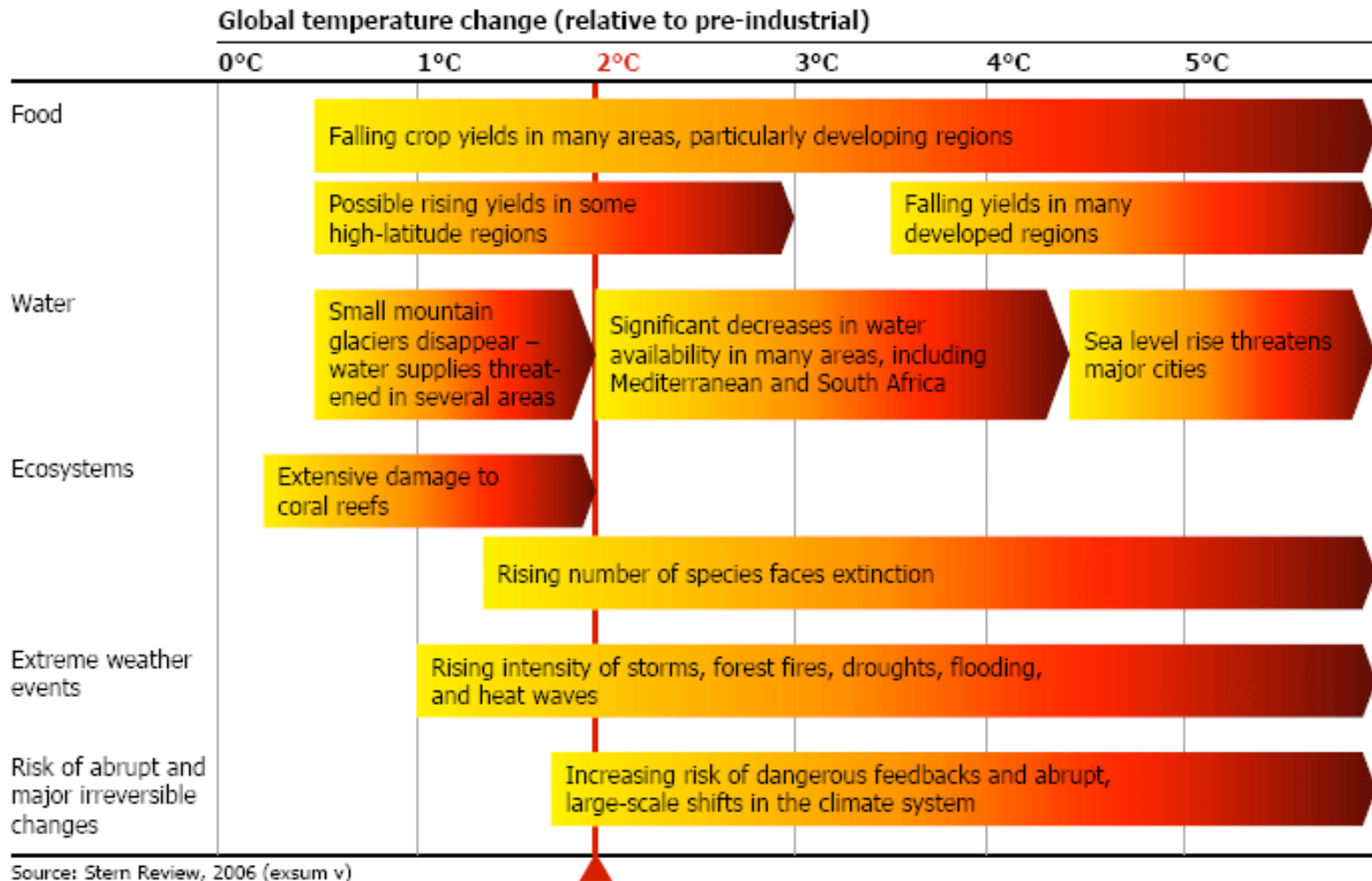
The New York Times, June 25, 2002

Hurricanes/Typhoons

(Category 4/5)



Impacts



The emissions space for stabilising CO₂ concentrations

WRE CO ₂ Stabilisation profiles	Year in which global emissions peak
450	2005 – 2015
550	2020 – 2030
650	2030 – 2045
750	2040 – 2060
1000	2065 – 2090

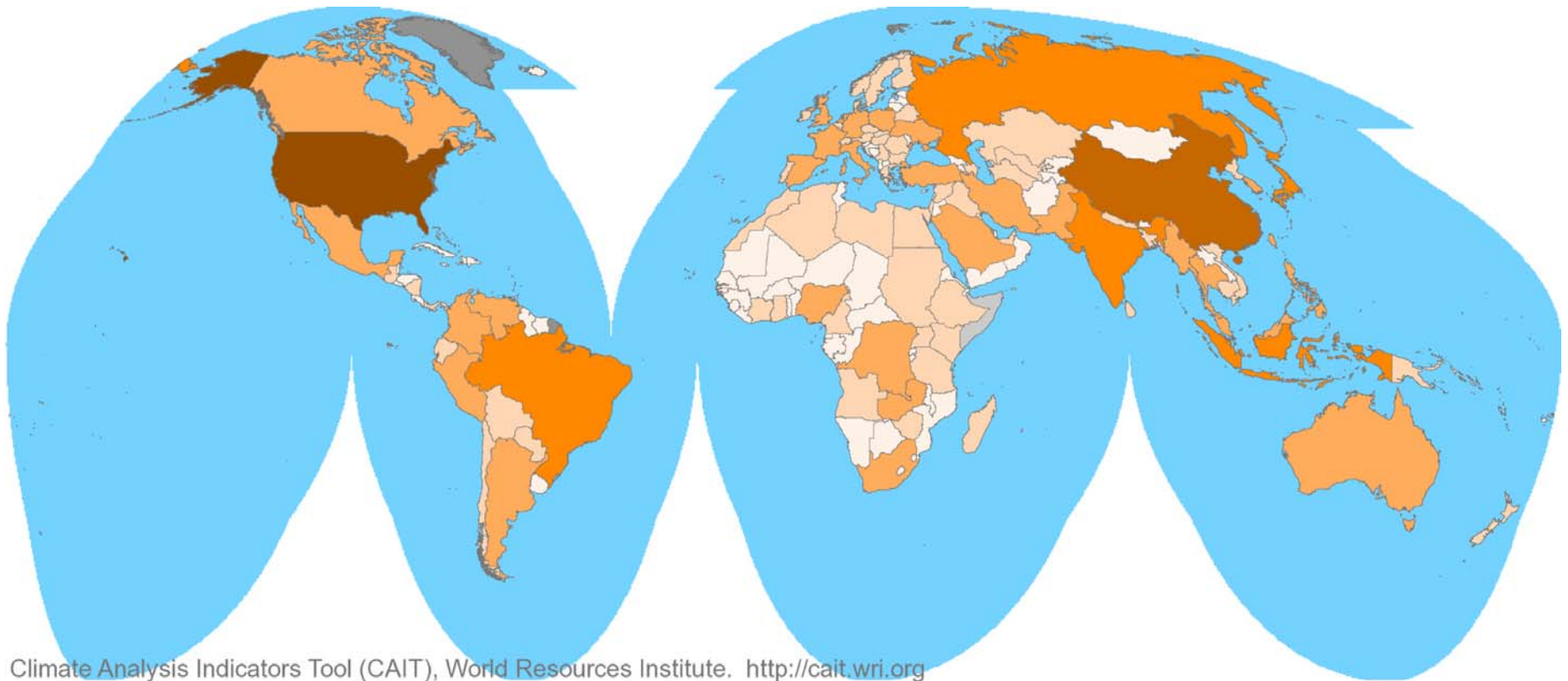
Source: IPCC-TAR Synthesis Report



Framing Mitigation:

Emissions and Key Emitters

National GHG Emissions, 2000



Millions Tons CO₂ Eq.

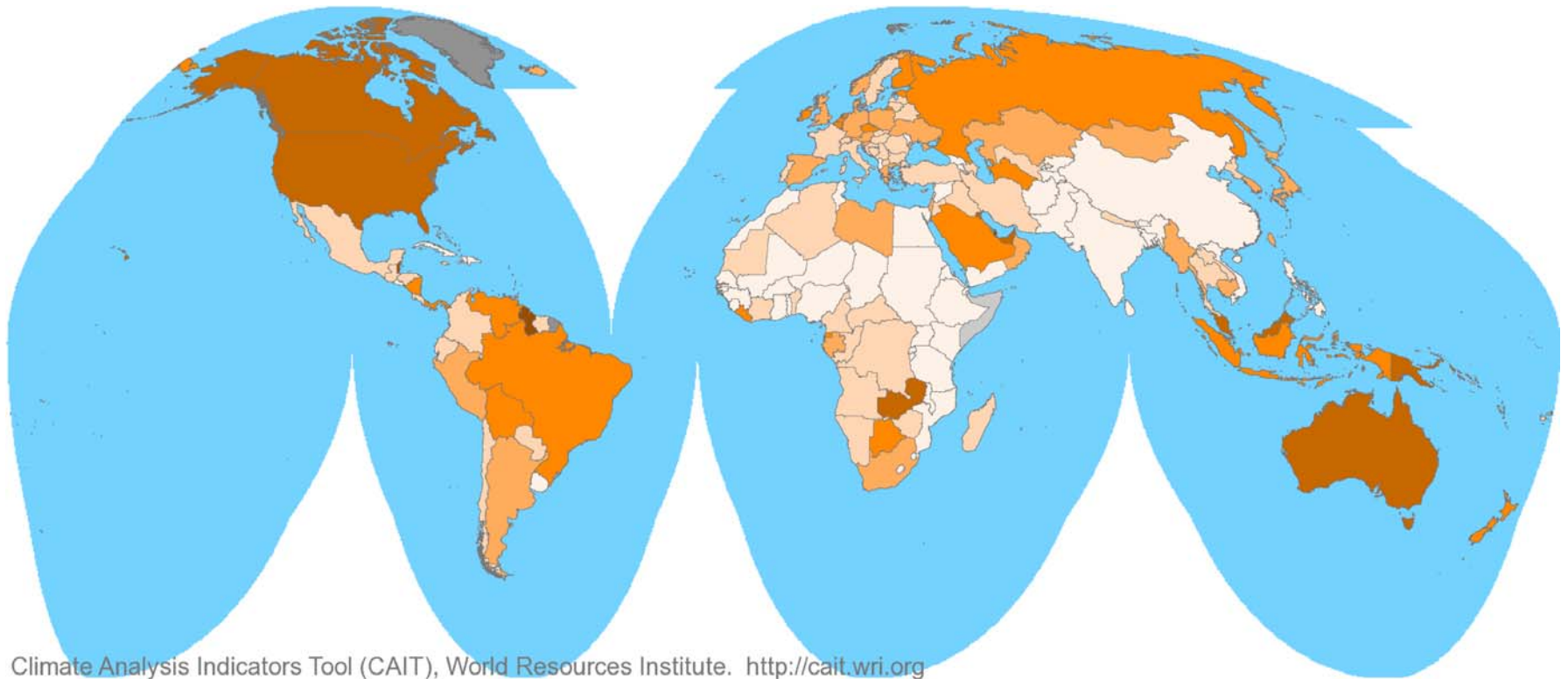
6,525
4,890
1,321 - 3,066

215 - 1,009
47 - 181
0 - 44

NA



Per Capita Emissions, 2000



Climate Analysis Indicators Tool (CAIT), World Resources Institute. <http://cait.wri.org>

Tons CO2 Eq.

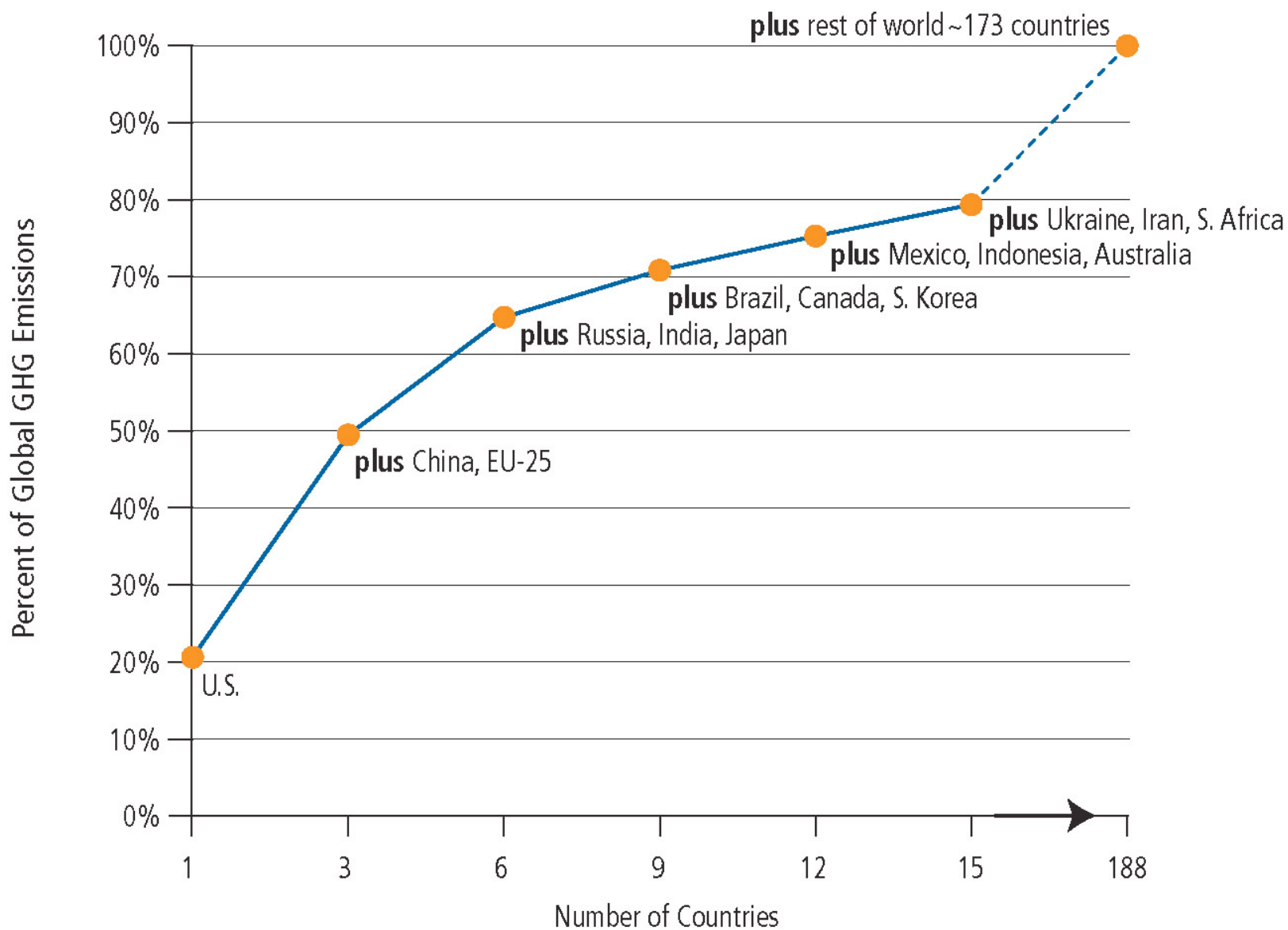
51 - 90
21 - 37
12.8 - 20.9

9.2 - 12.4
4.17 - 9.15
0.15 - 4.13

NA



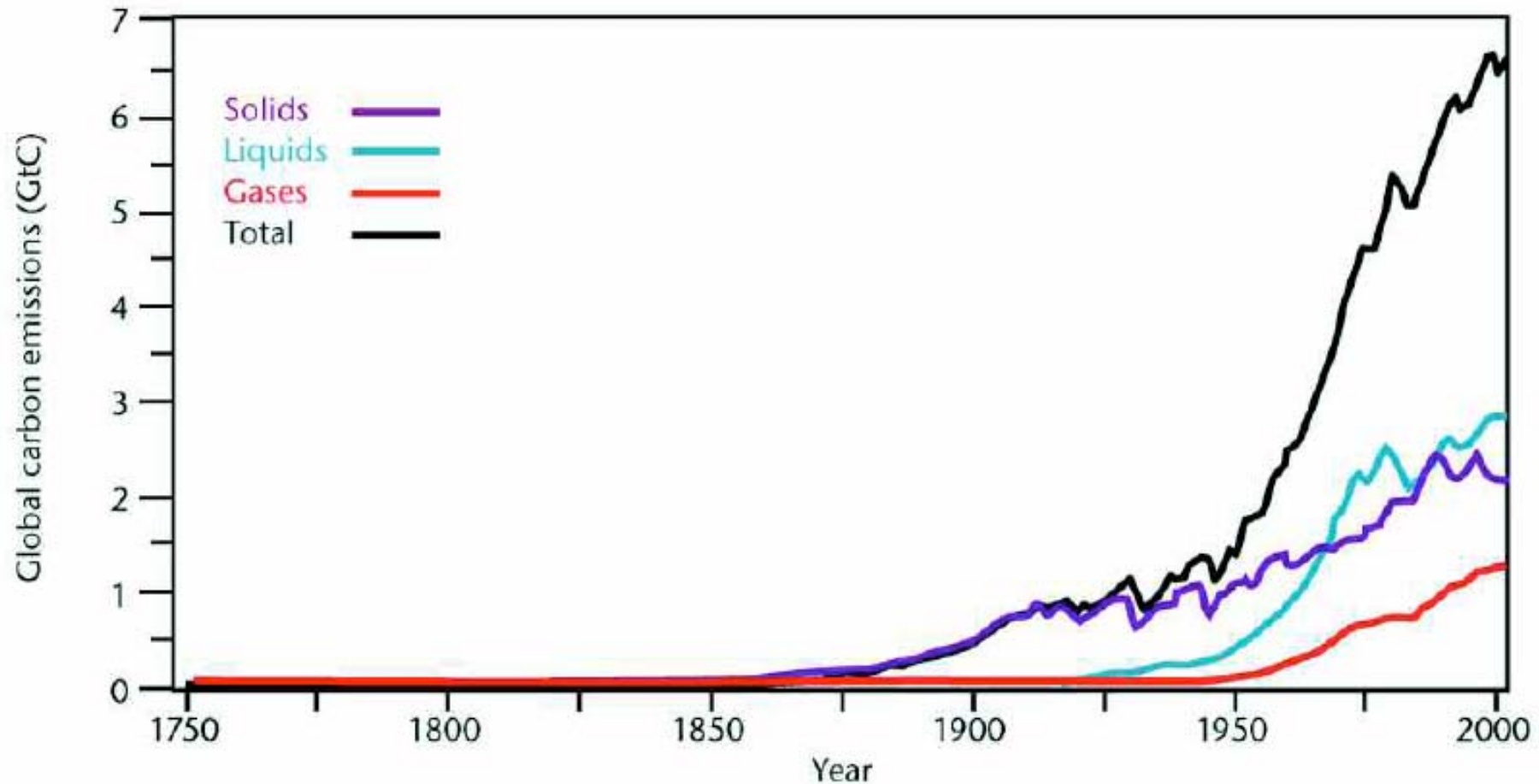
Largest Emitters: *Developed & Developing*



Source: WRI, Baumert et al, 2005



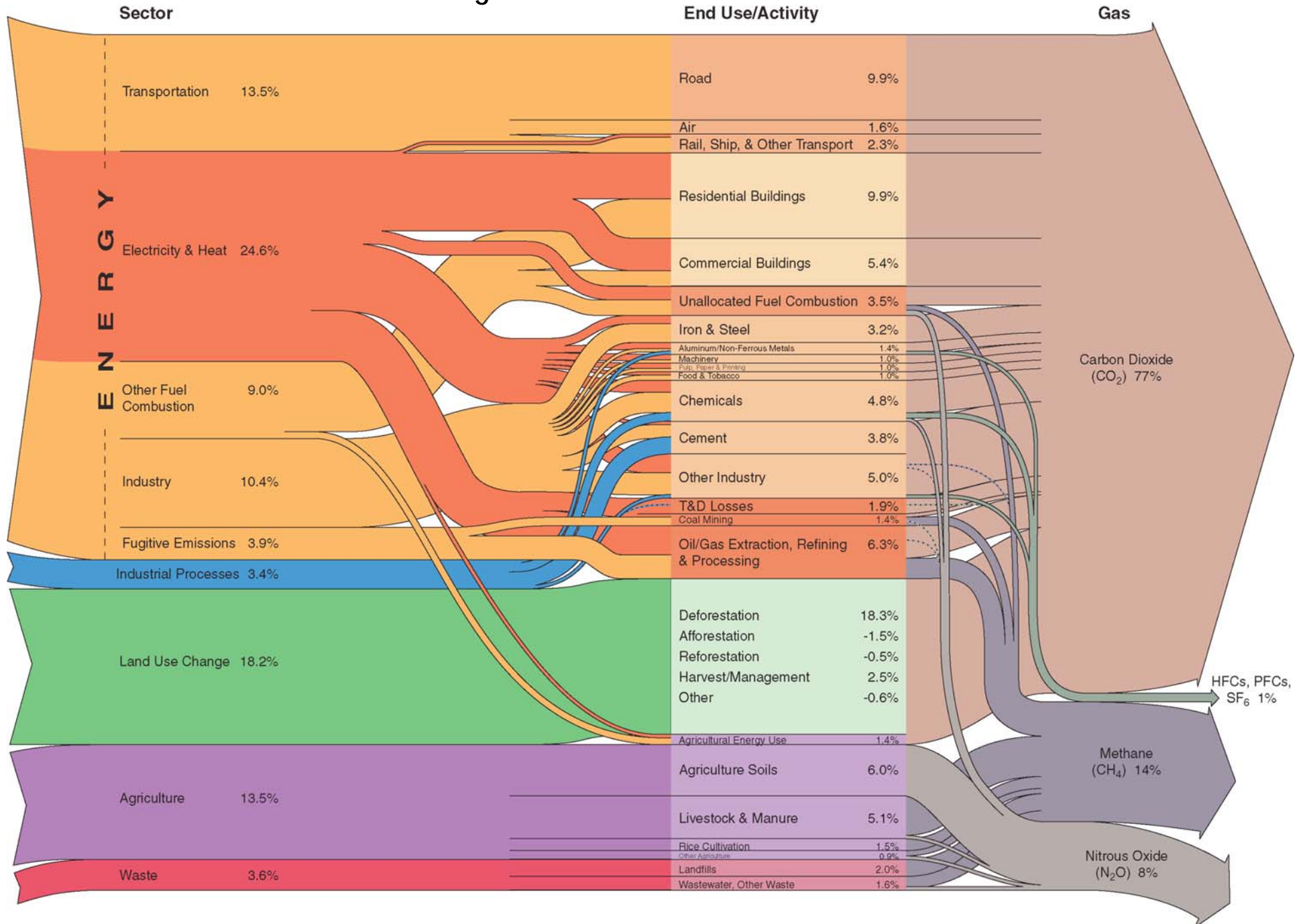
Fossil Fuels are the Primary Source of Global Carbon Emissions



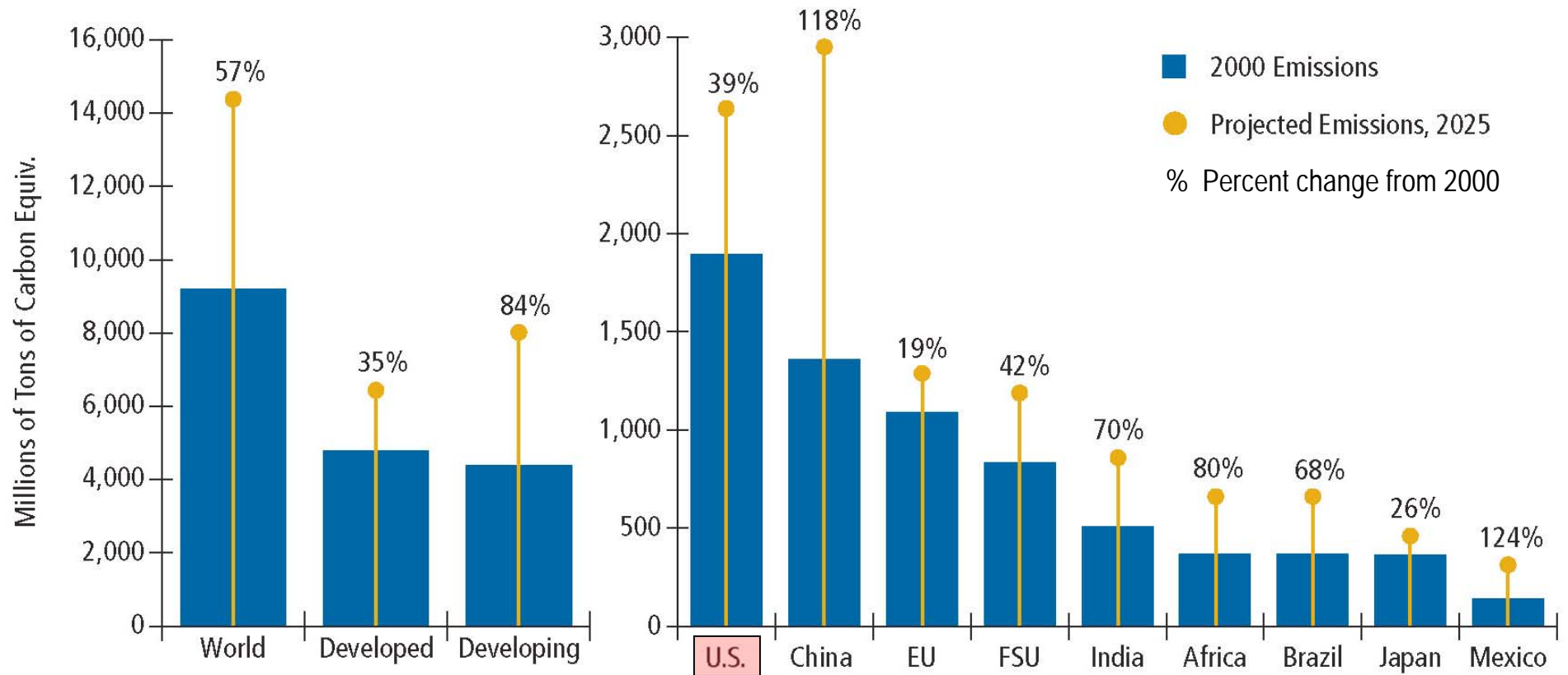
Source: CDIAC, 2005



GHG Flow Diagram: Global Greenhouse Gas Emissions



Projected Future GHG Emissions Growth



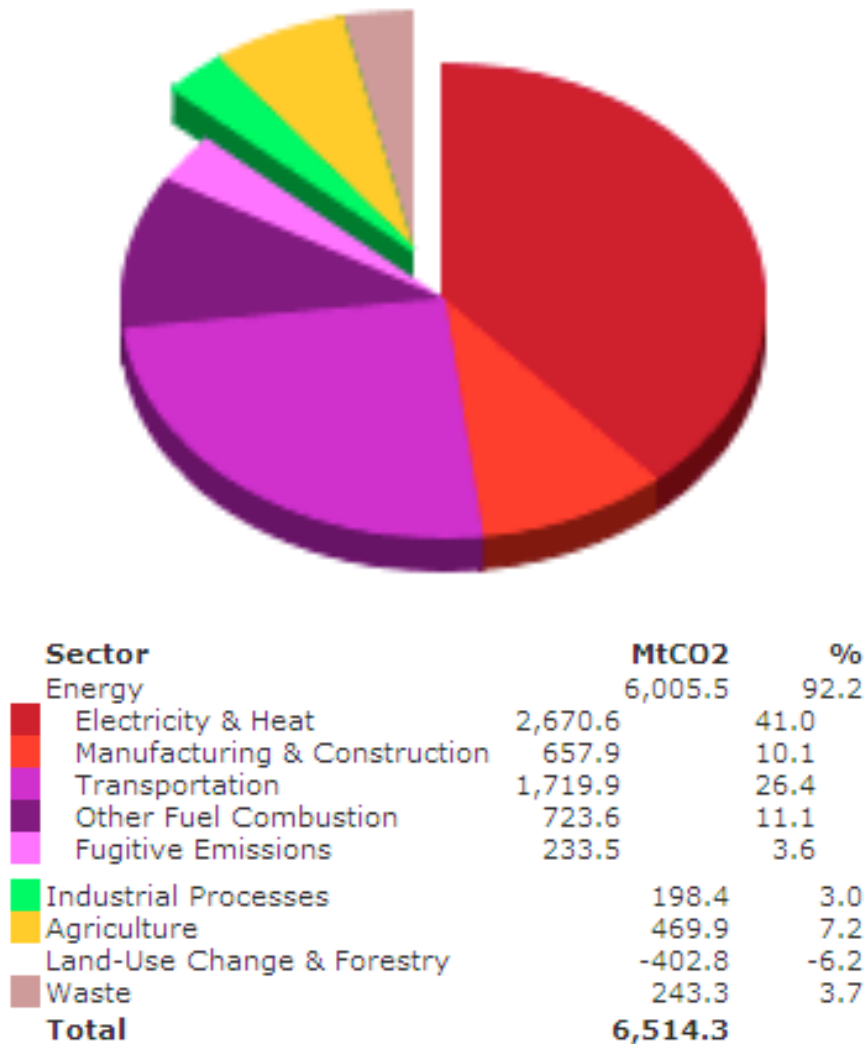
Source: WRI, Baumert et al, 2005



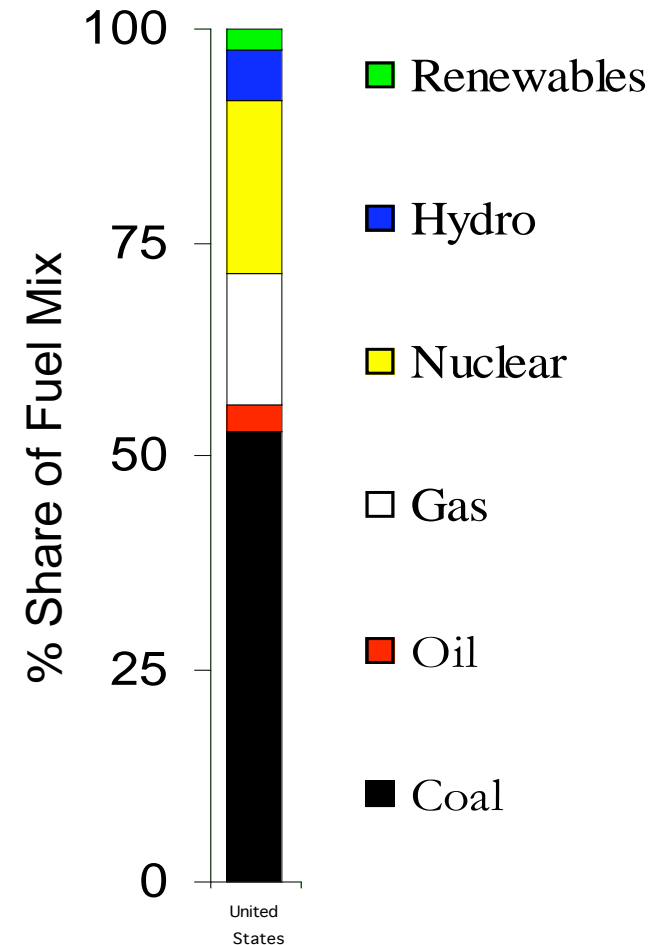
Key Countries

The USA

U.S. Emissions Mix

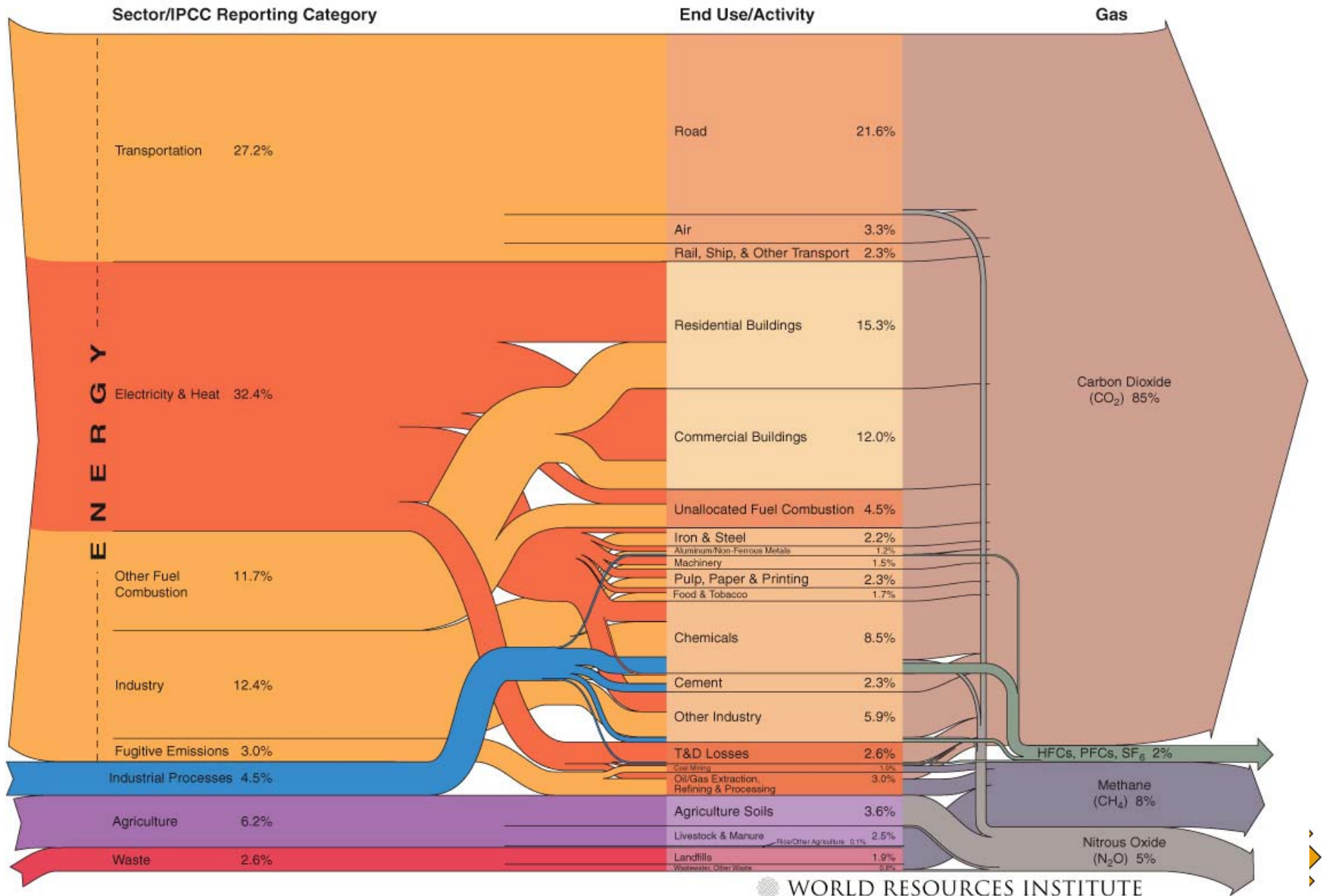


Source: WRI/CAIT



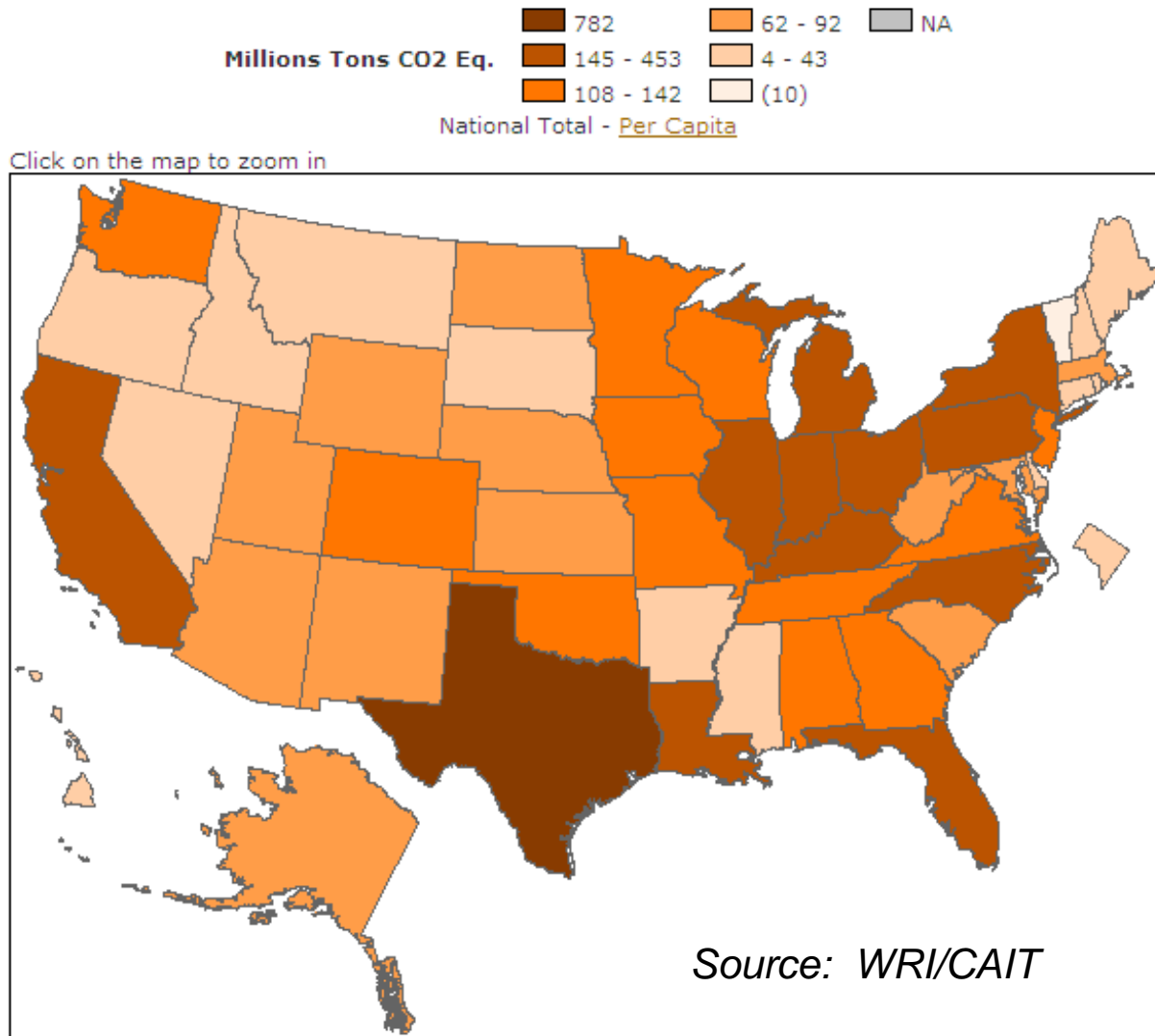
Source: IEA Statistics

U.S. GHG Emissions Flow Chart

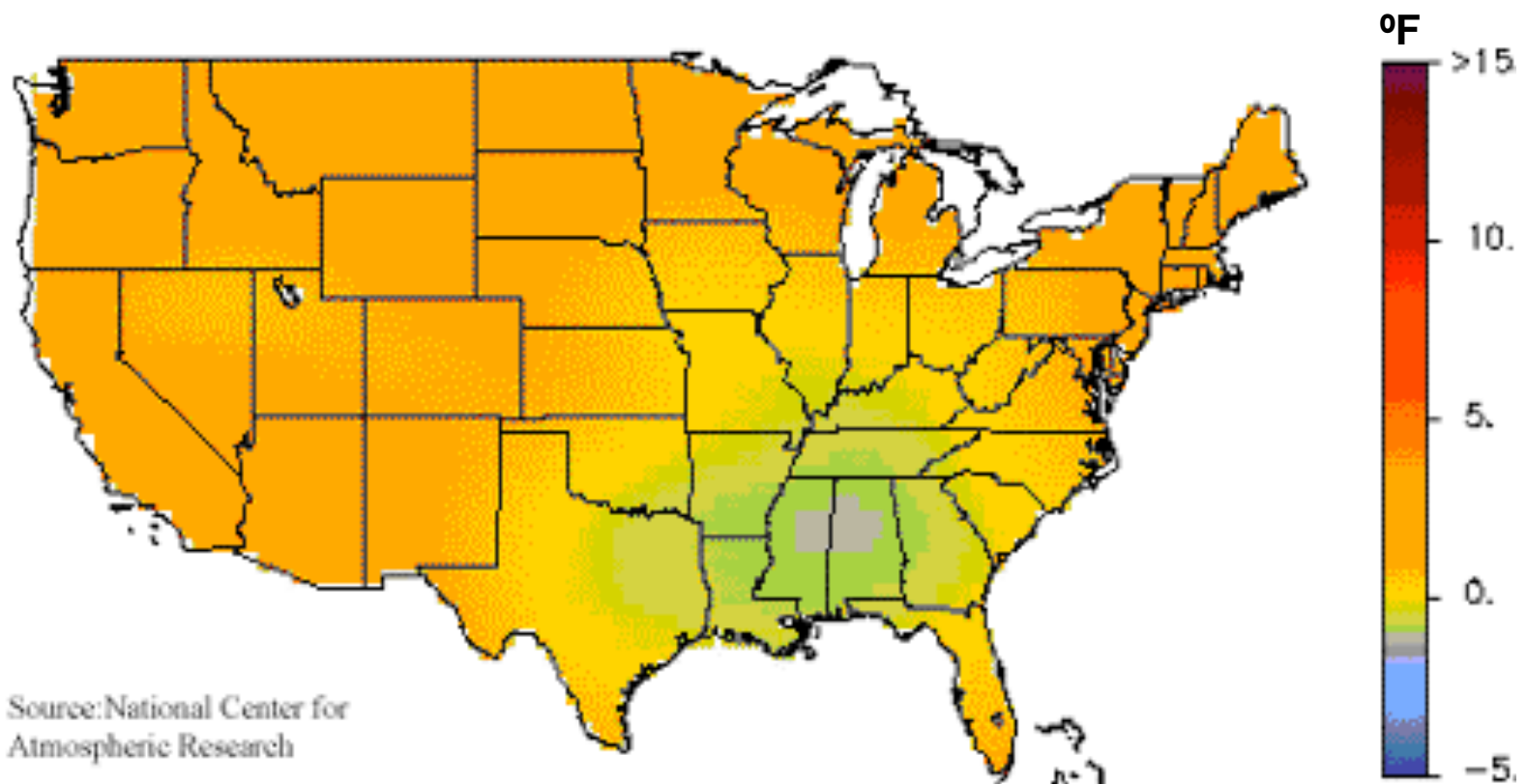


State GHG Emissions, 2001

MT CO2 eq of CO2, CH4, N2O, PFCs, SF6, includes land use



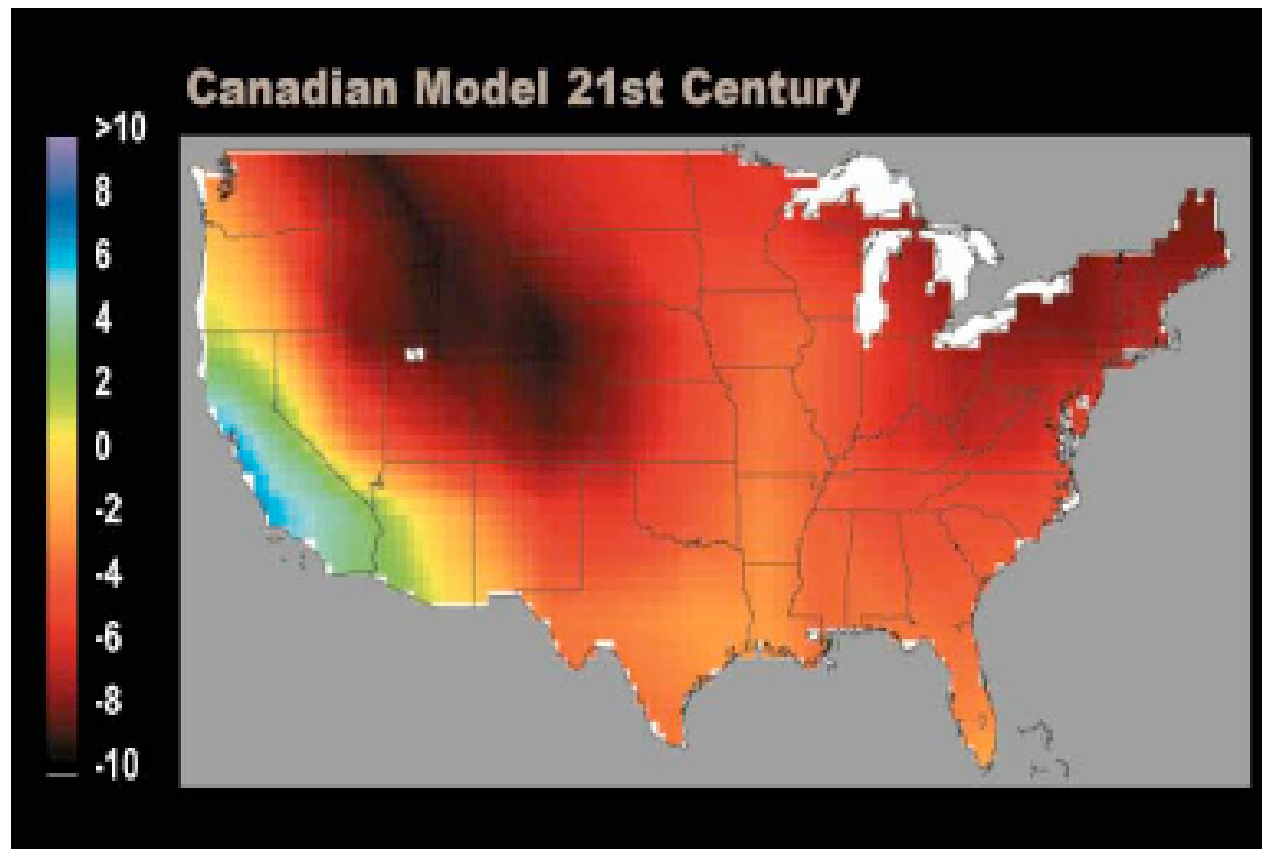
Change over 20th Century: Annual Mean Temperature



Source: National Center for
Atmospheric Research



Drought Expectations



The Palmer Index is most effective in determining long term drought—a matter of several months—and is not as good with short-term forecasts (a matter of weeks). It uses a 0 as normal, and drought is shown in terms of minus numbers; for example, minus 2 is moderate drought, minus 3 is severe drought, and minus 4 is extreme drought.



A one meter sea level rise



Popular Opinion Is Shifting



Hurricane Katrina

August 28, 2005

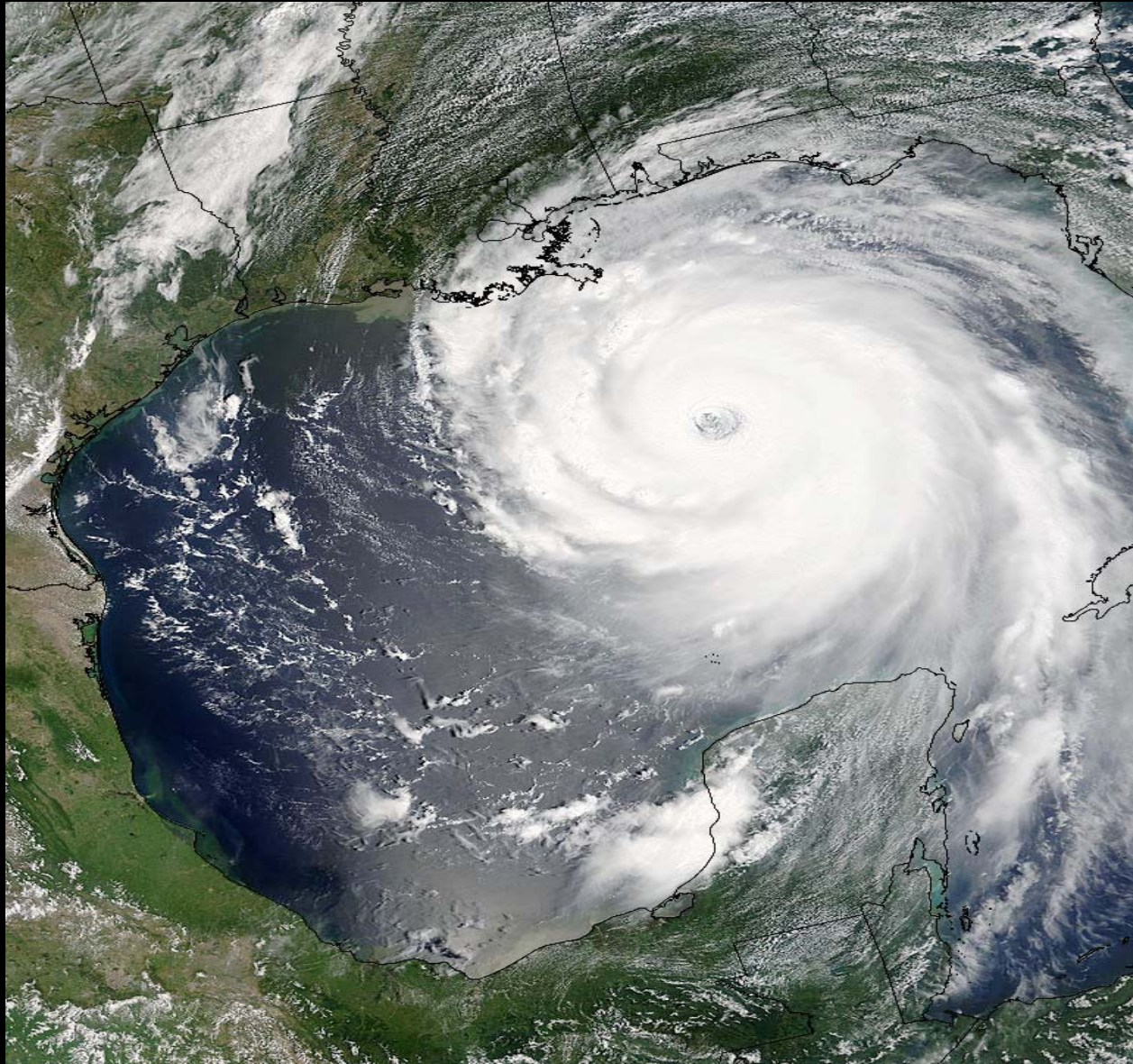
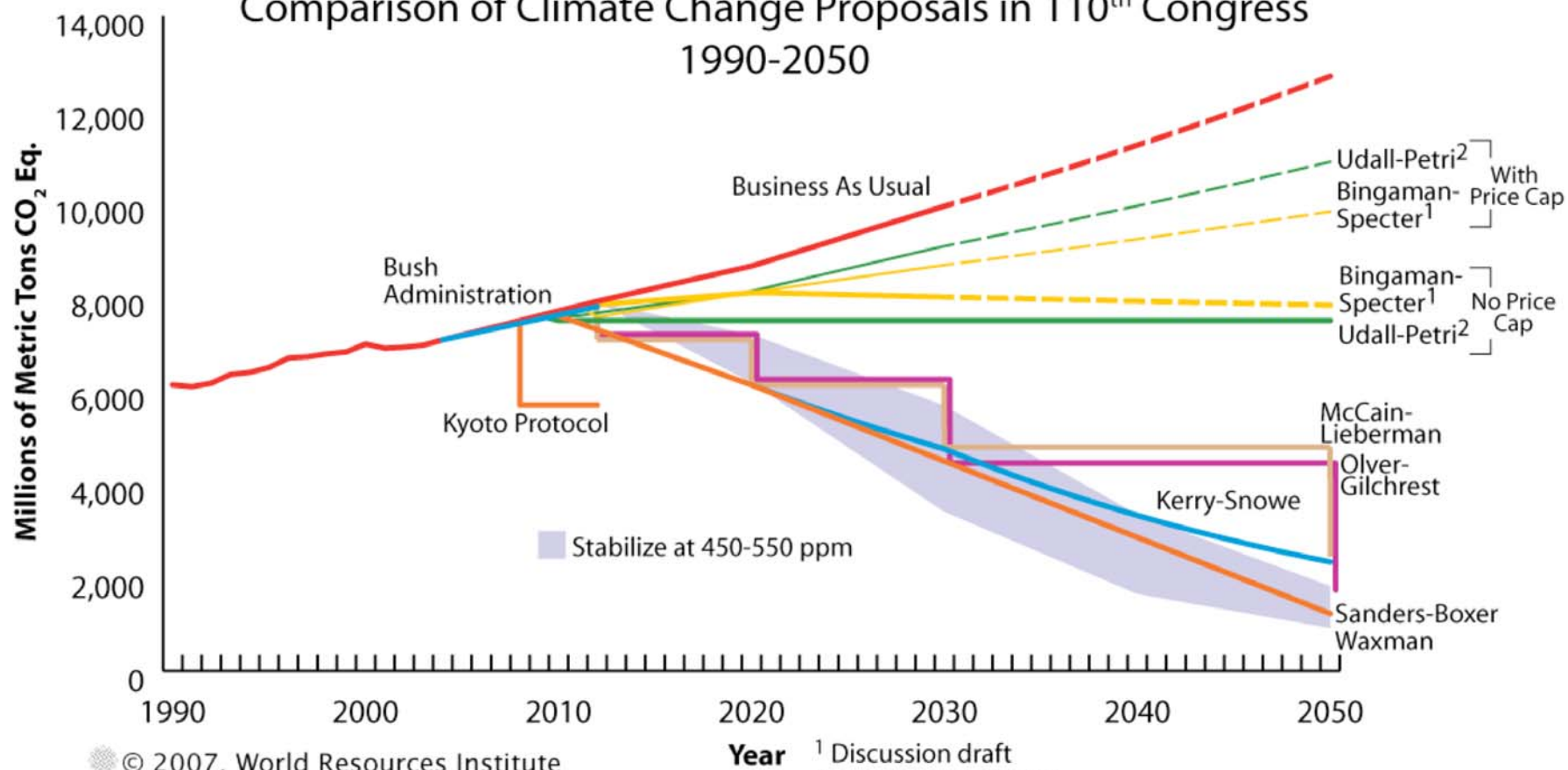


Photo Credit: NASA/Jeff
Schmaltz, MODIS Land
Rapid Response Team



Comparison of Climate Change Proposals in 110th Congress 1990-2050



© 2007, World Resources Institute

Year

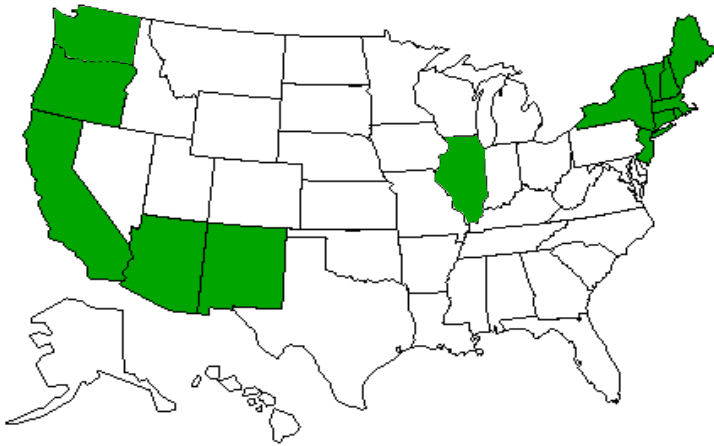
¹ Discussion draft

² Submitted in 109th Congress

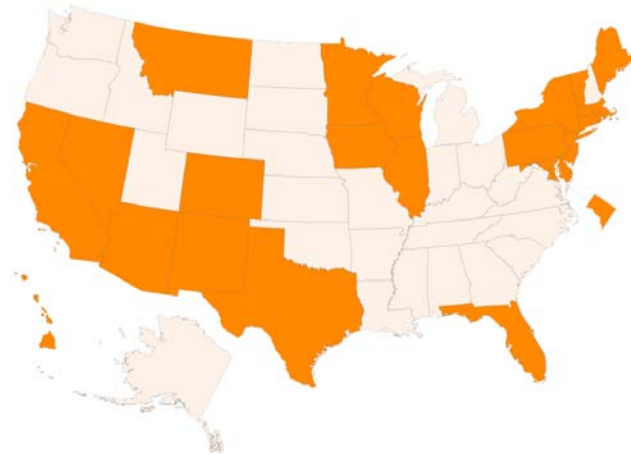
Dotted lines indicate extrapolations of EIA projections



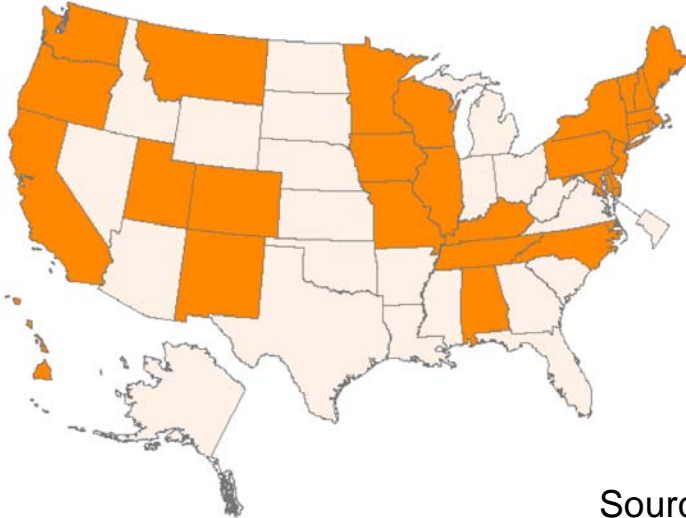
State Emission Targets



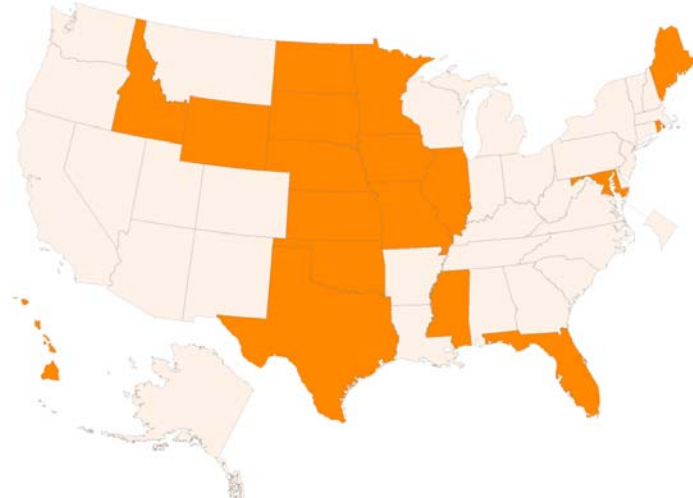
Renewable Portfolio Standard



State Action Plans



Ethanol Mandate



Source: WRI, CAIT





USCAP
United States
Climate Action
Partnership

"We are committed to a pathway that will slow, stop and reverse the growth of U.S. emissions while expanding the U.S. economy."

USCAP Proposal

- Call for a cap and trade program
- Establishment of a national GHG inventory and registry
- Credit for early action
- Aggressive technology research and development
- Policies to discourage new investments in high-emitting facilities
- Policies to accelerate deployment of zero and low-emitting technologies and energy efficiency



e

ENVIRONMENTAL DEFENSE
finding the ways that work



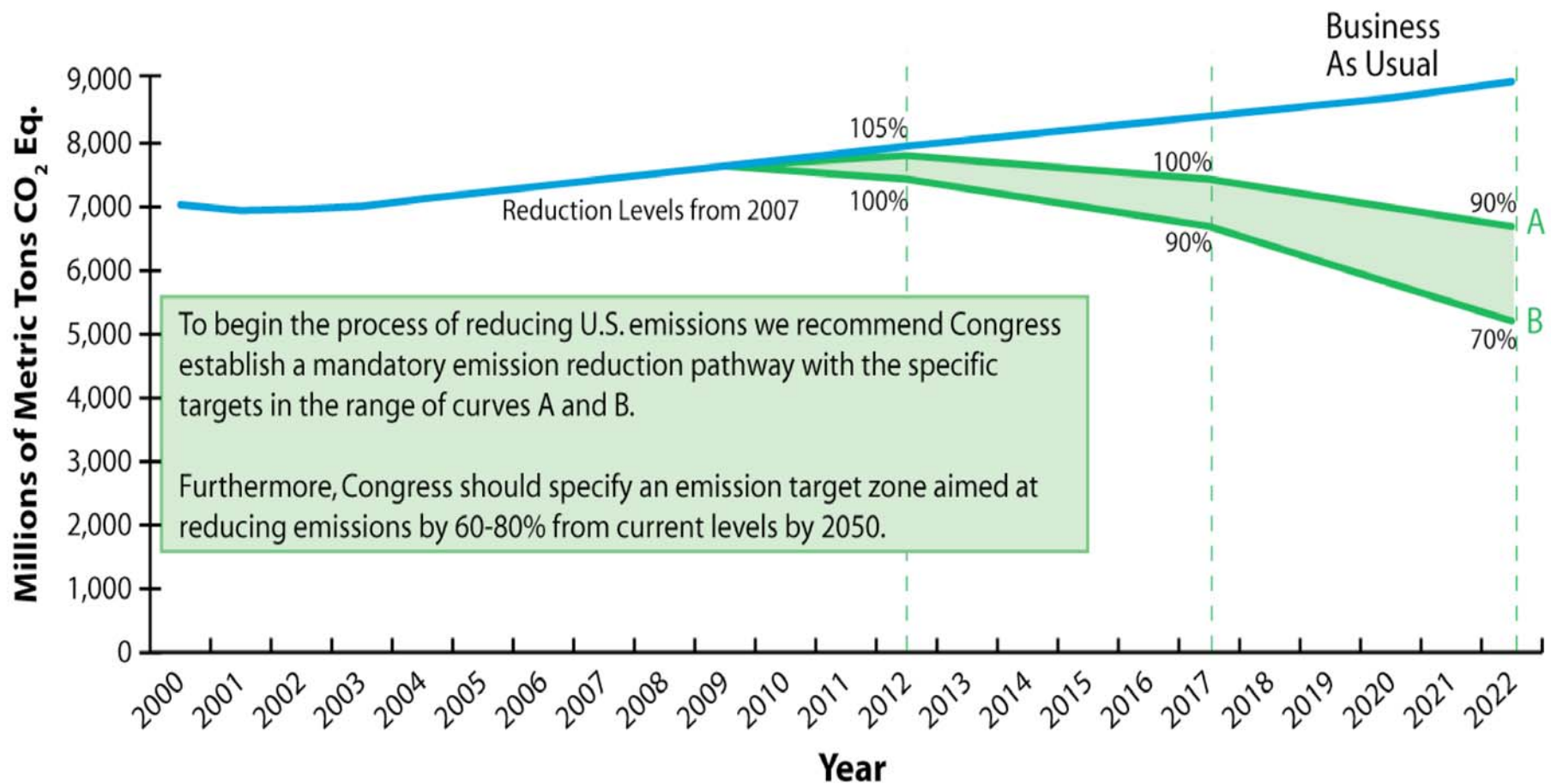
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LEHMAN BROTHERS



USCAP Recommended Reductions



The Energy Information Administrations Annual Energy Outlook 2006 reference case scenario is used for business as usual through 2030.

<http://www.eia.doe.gov/oiaf/archive/aeo06/index.html>

Source: USCAP, 2007

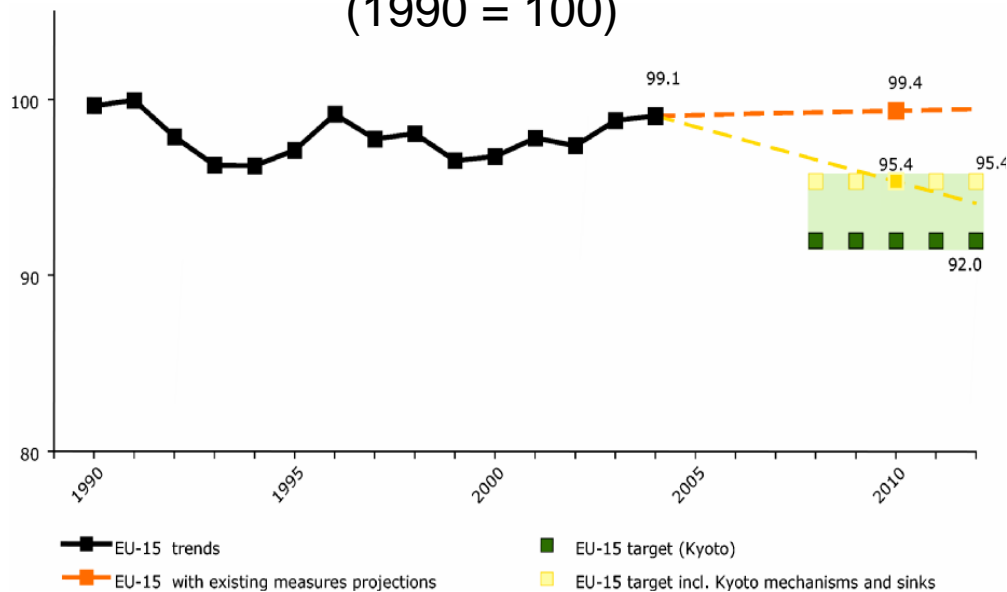


Key Actors

The EU

Europe

EU GHG Trends and Projections
(1990 = 100)

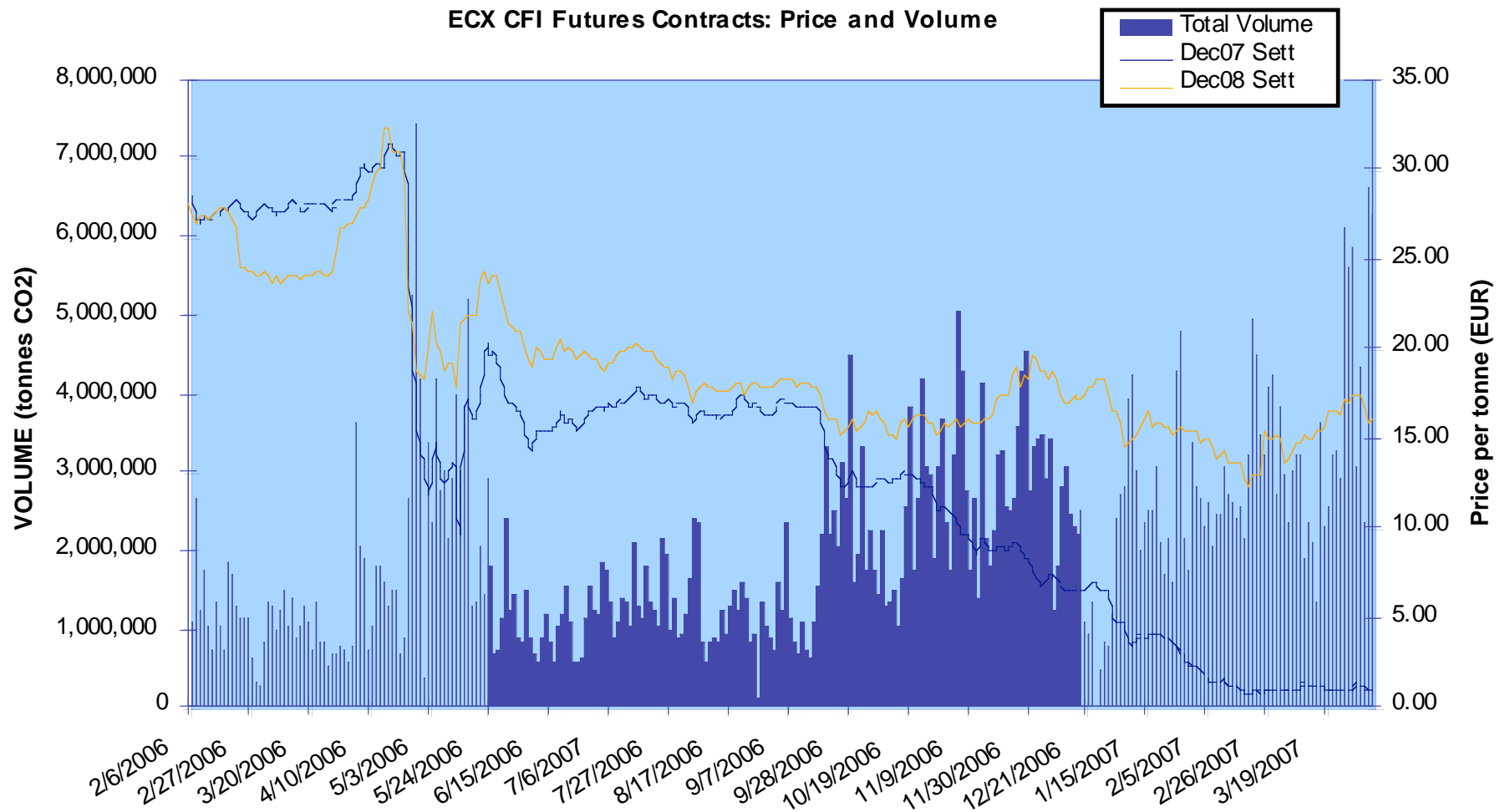


Source: EU Environment Agency

- The EU aims to commit itself, as part of an international climate protection agreement, to a 30% reduction in its greenhouse gas emissions by 2020 (compared with 1990).
- Until a new agreement is concluded, and without prejudice to its position in international negotiations, the EU will reduce its emissions by at least 20% by 2020 (compared with 1990).



EUA closing prices: 2006 - Present



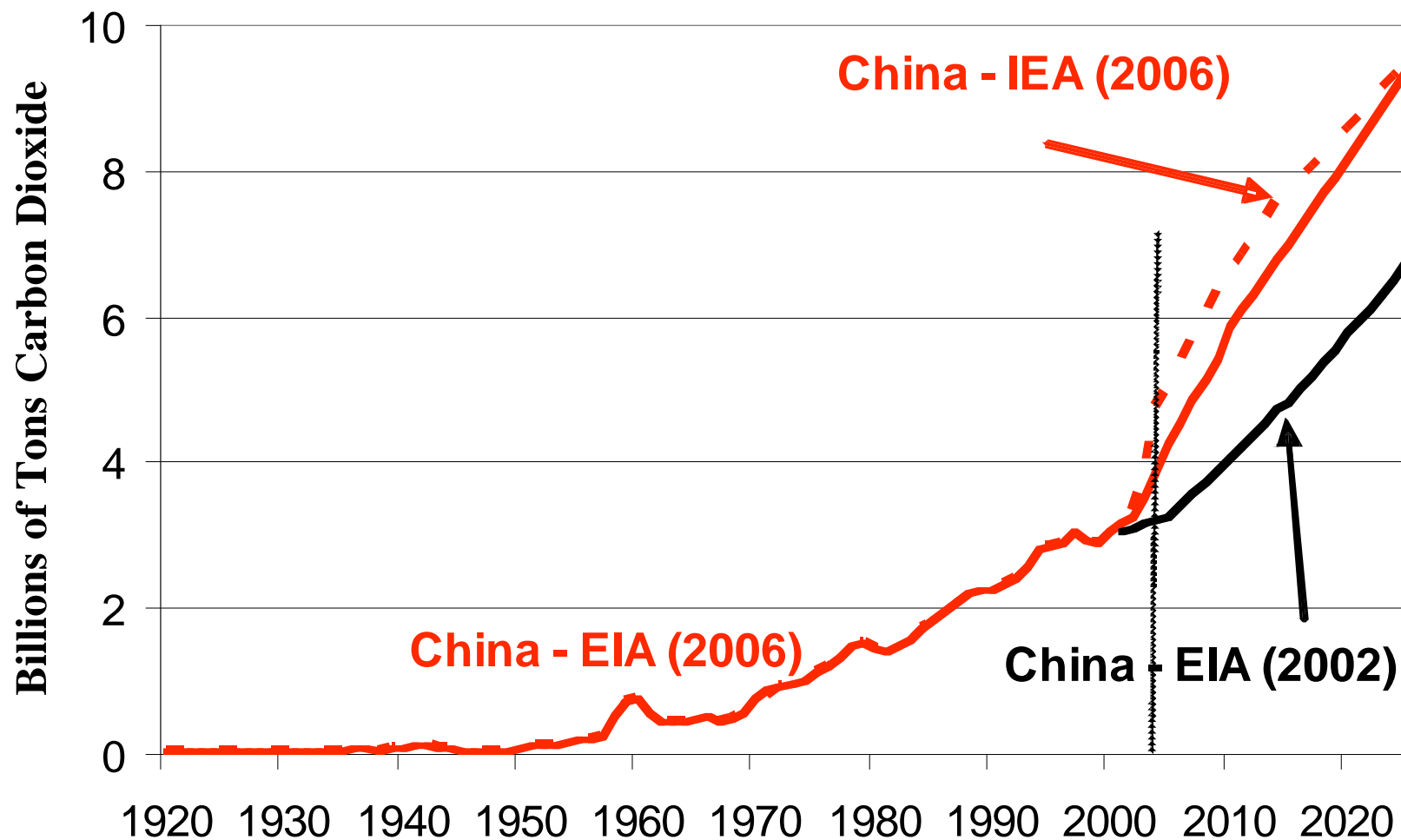
Source: ECX.com



Key Countries

China

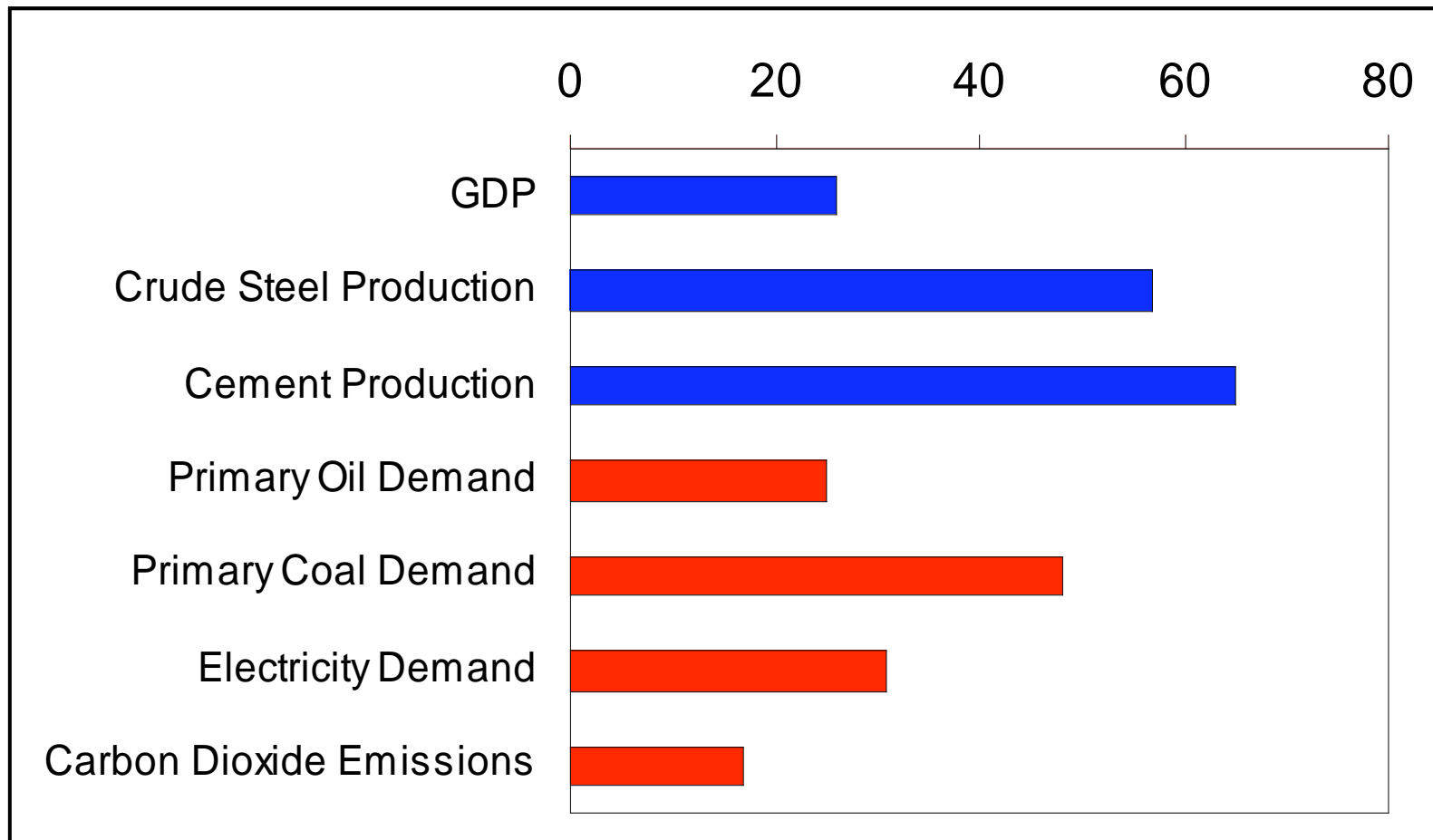
Chinese CO₂ Emissions



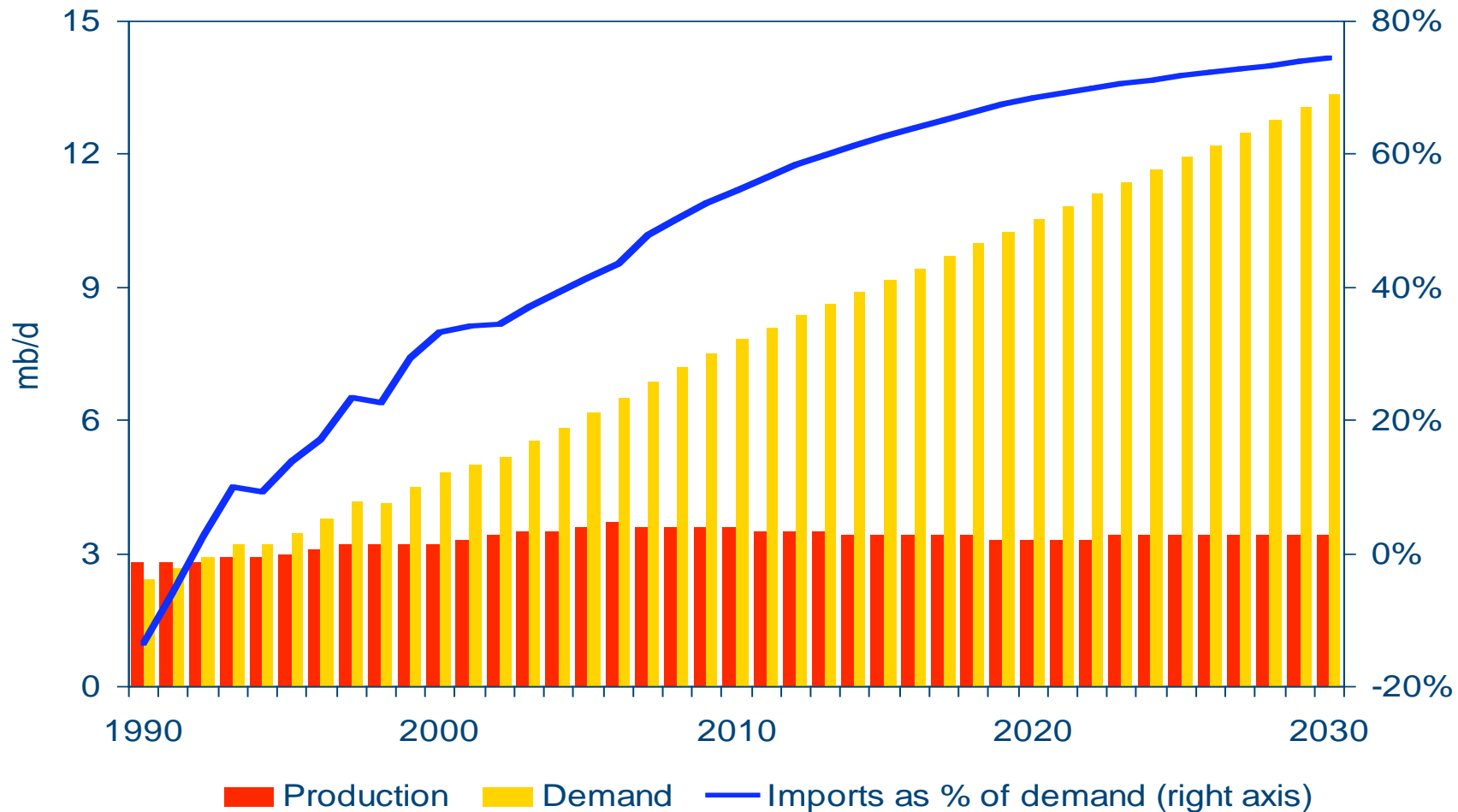
Source: WRI, based on IEA & EIA data



China's Share of Incremental World Growth (1998-2003)



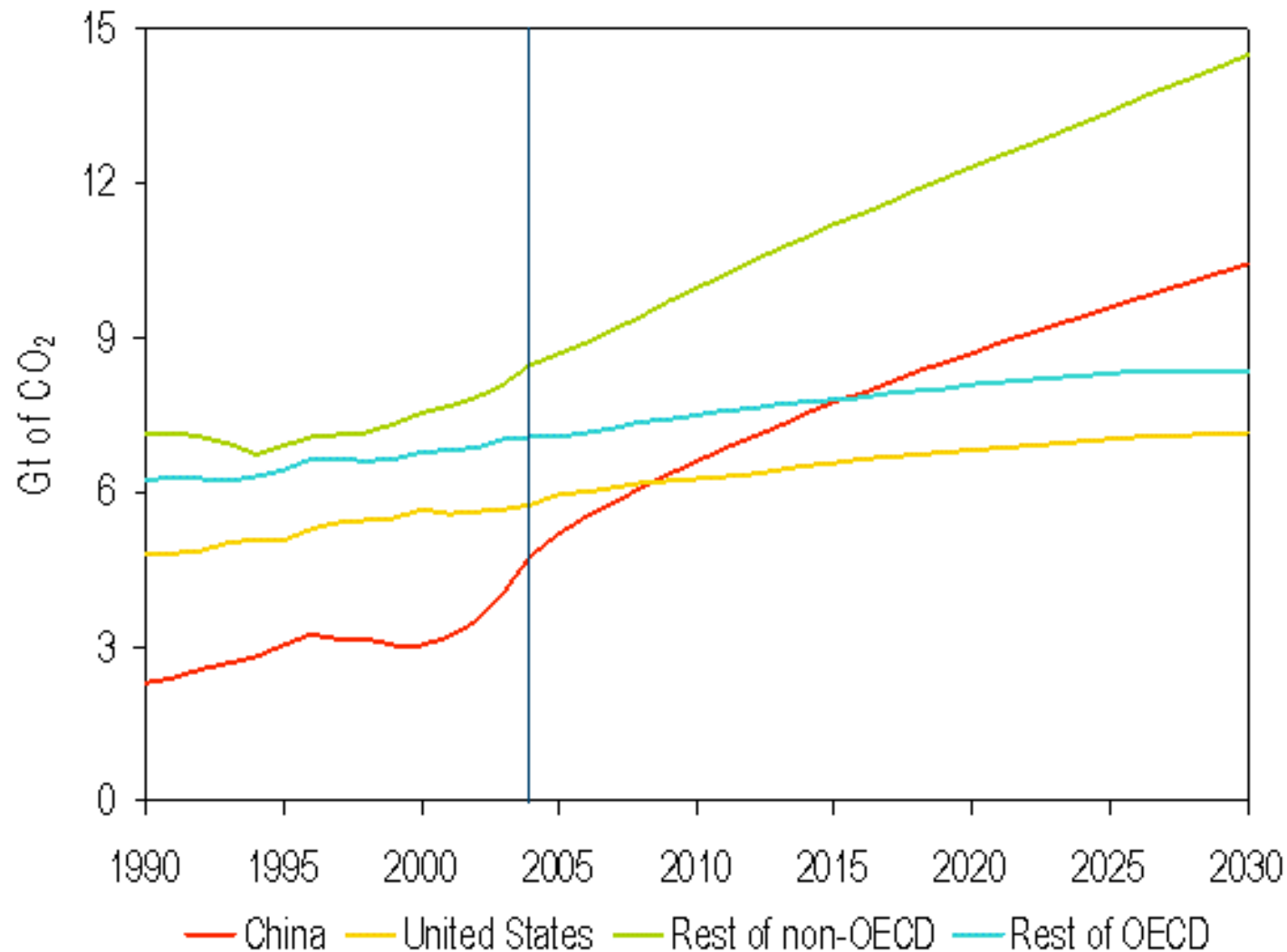
PRC Oil Supply Balance



China's oil imports will increase from around 2.4 mb/d now to almost 10 mb/d in 2030 – equal to 75% of domestic demand



CO₂ Emissions Trends 2005 - 2030



Source: IEA WEO, 2006

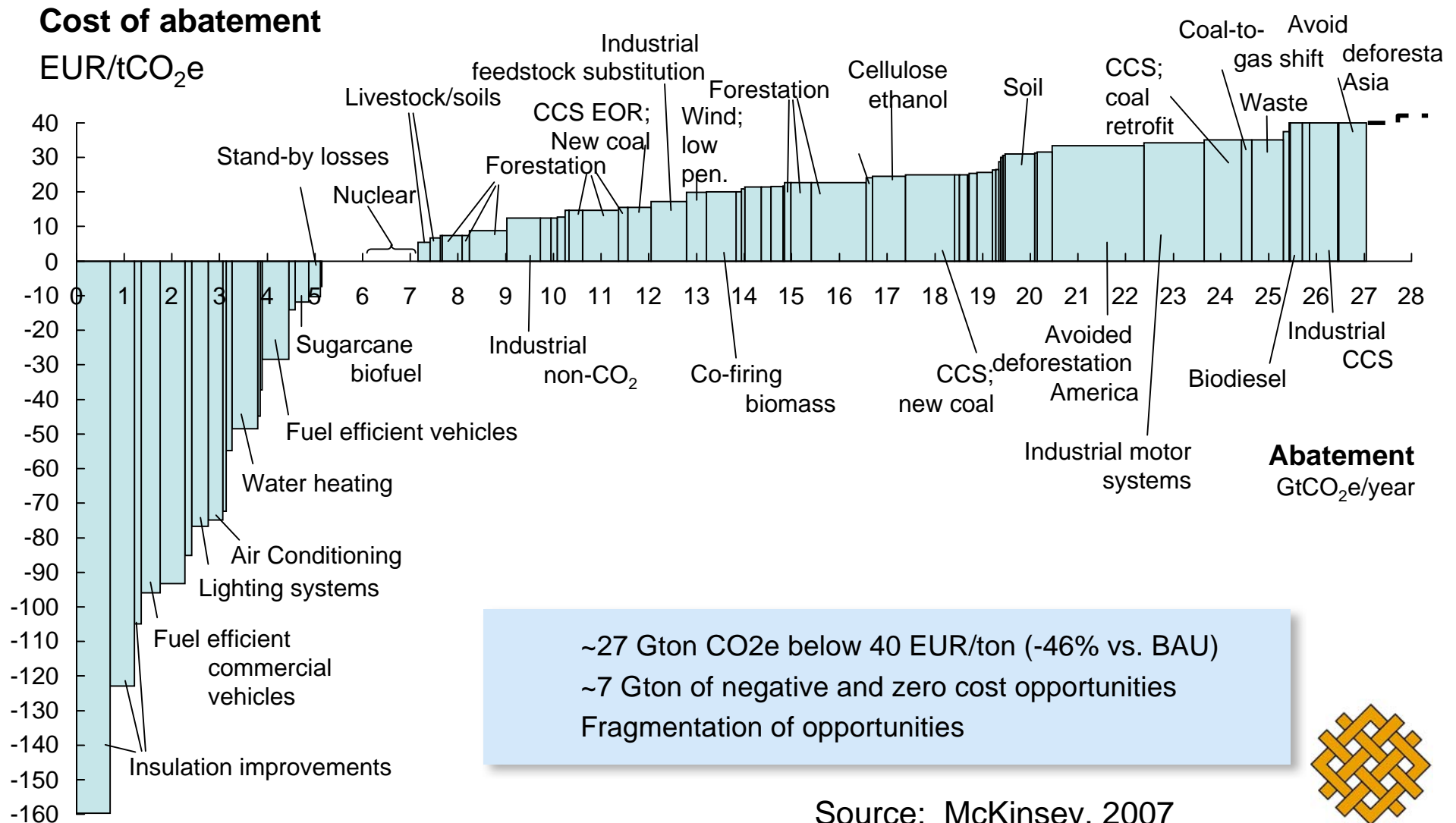


Mitigation Solutions



Global cost curve of GHG abatement opportunities beyond BAU

2030

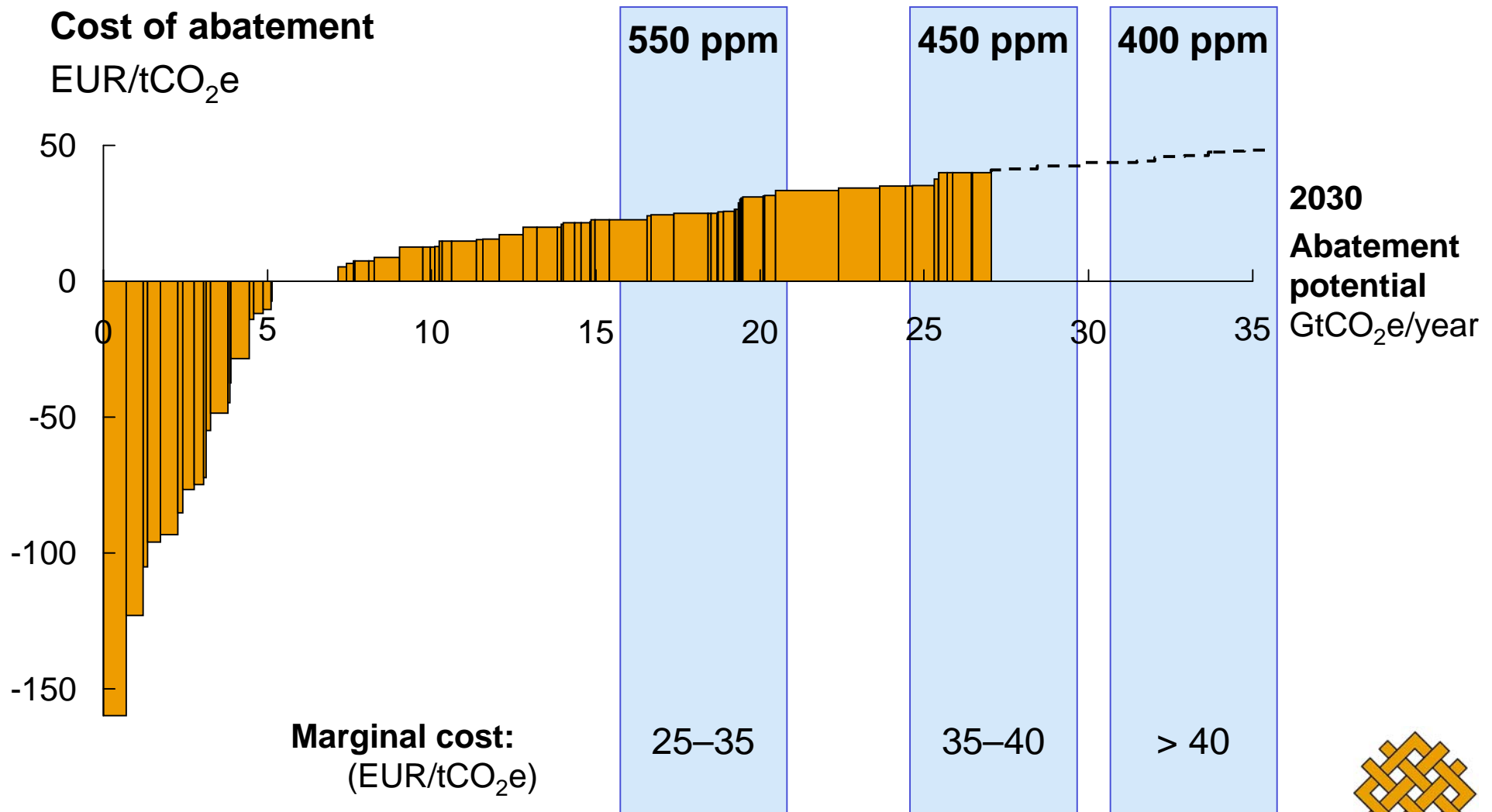


Source: McKinsey, 2007



Marginal abatement cost in the different scenarios*

Source: McKinsey, 2007

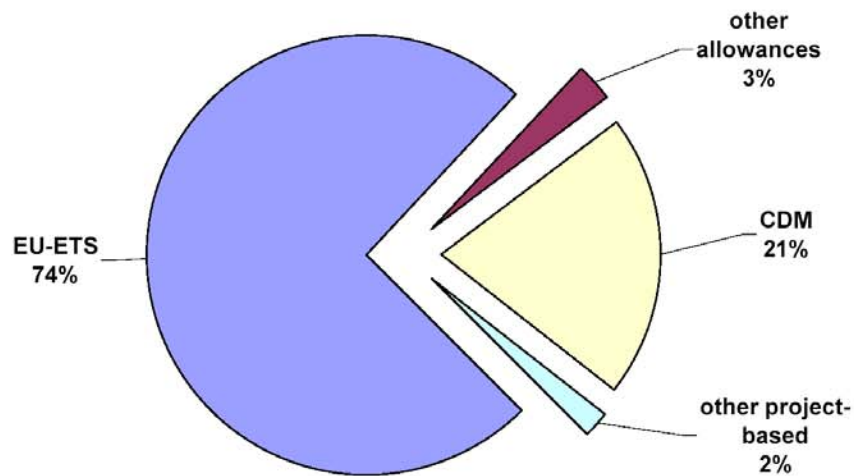


* Assuming opportunities are addressed in order of increasing cost

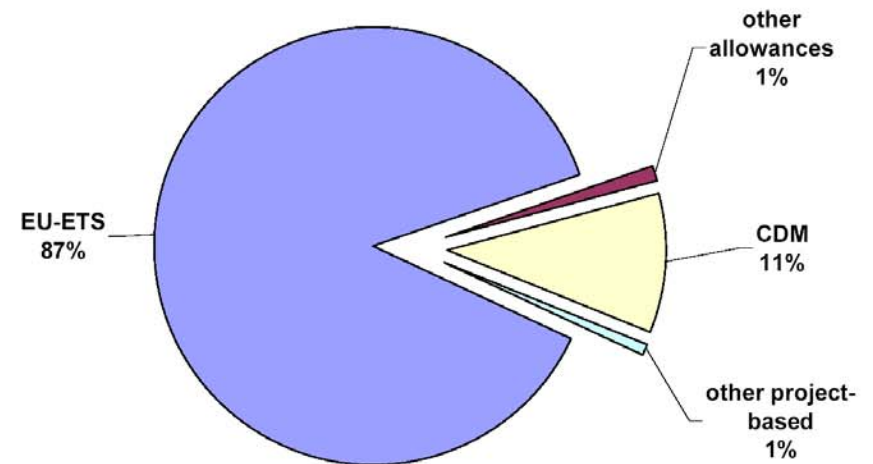


The Carbon Market

(1/2005 – 9/2006)



Volume
~716 MMTCE

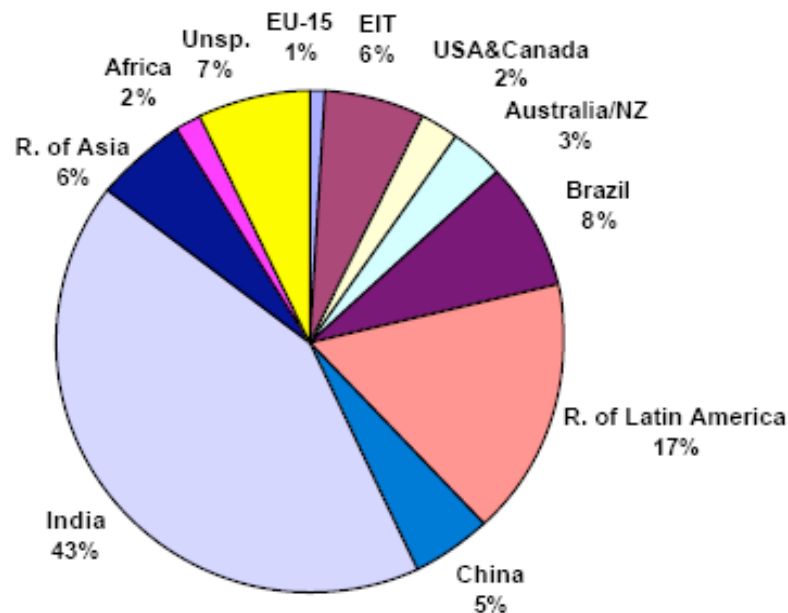


Value
~\$21.5 billion

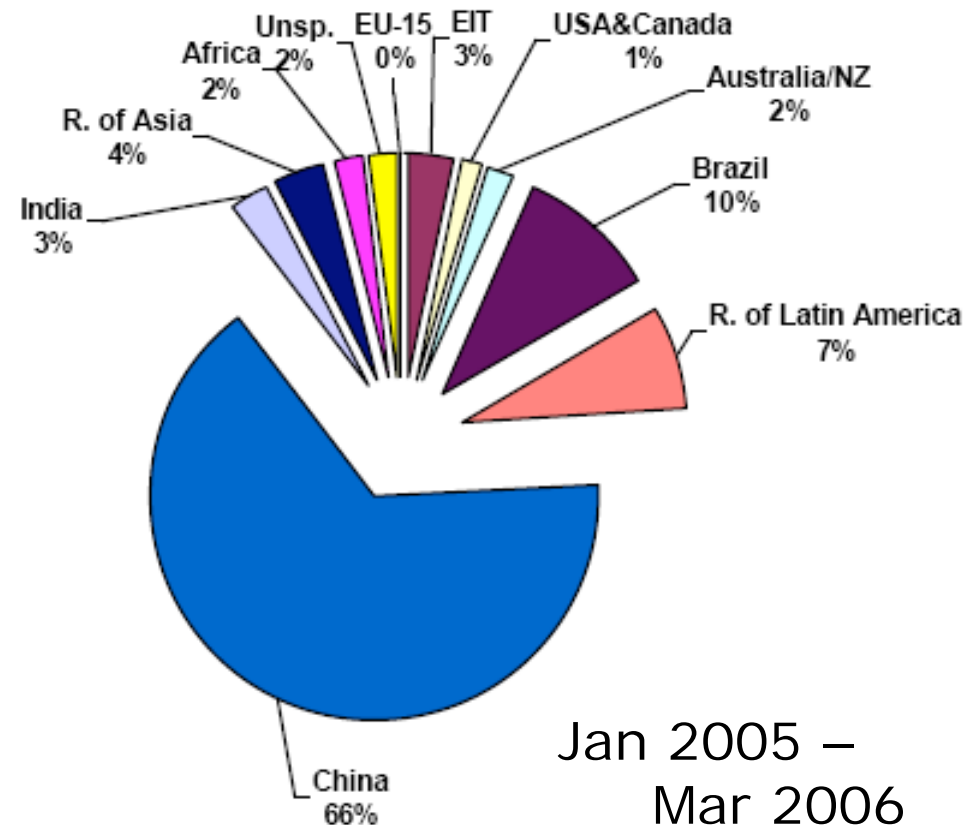
Source: IETA/World Bank 2006



Supply Trends and Developments



Jan- Dec 2004



Jan 2005 –
Mar 2006

Source: IETA/World Bank 2006



Directions for the future: Risk *AND* Opportunity



Investment and Policy Priorities

Sector	Near Term Priorities	Medium term Priorities	Long term priorities
Power	Avoid lock-in of conventional coal	Post-combustion CCS; RE	Biomass + CCS; safe nuclear
Buildings	Avoid lock-in of inefficient buildings	Carbon neutral building design	
Transport	Avoid lock-in of inefficient infrastructure	Sustainable fuel systems	Transport innovation
Industry	Avoid lock-in of inefficient production	Advanced industrial production	Low emissions intensity material use
Land Use	Slow deforestation	Enhance sinks; change Ag practices	



“DuPont's mission is Sustainable Growth....We have the choice to view major societal concerns...as things that we must defend. Or we can see them as opportunities to create solutions that not only improve our bottom line but also create tremendous benefit for society. “



The miracles of science™



“This is a win-win for shareholders and the environment.”

“Green **is** green, and that it will make a difference on the bottom line for GE investors.”



imagination at work

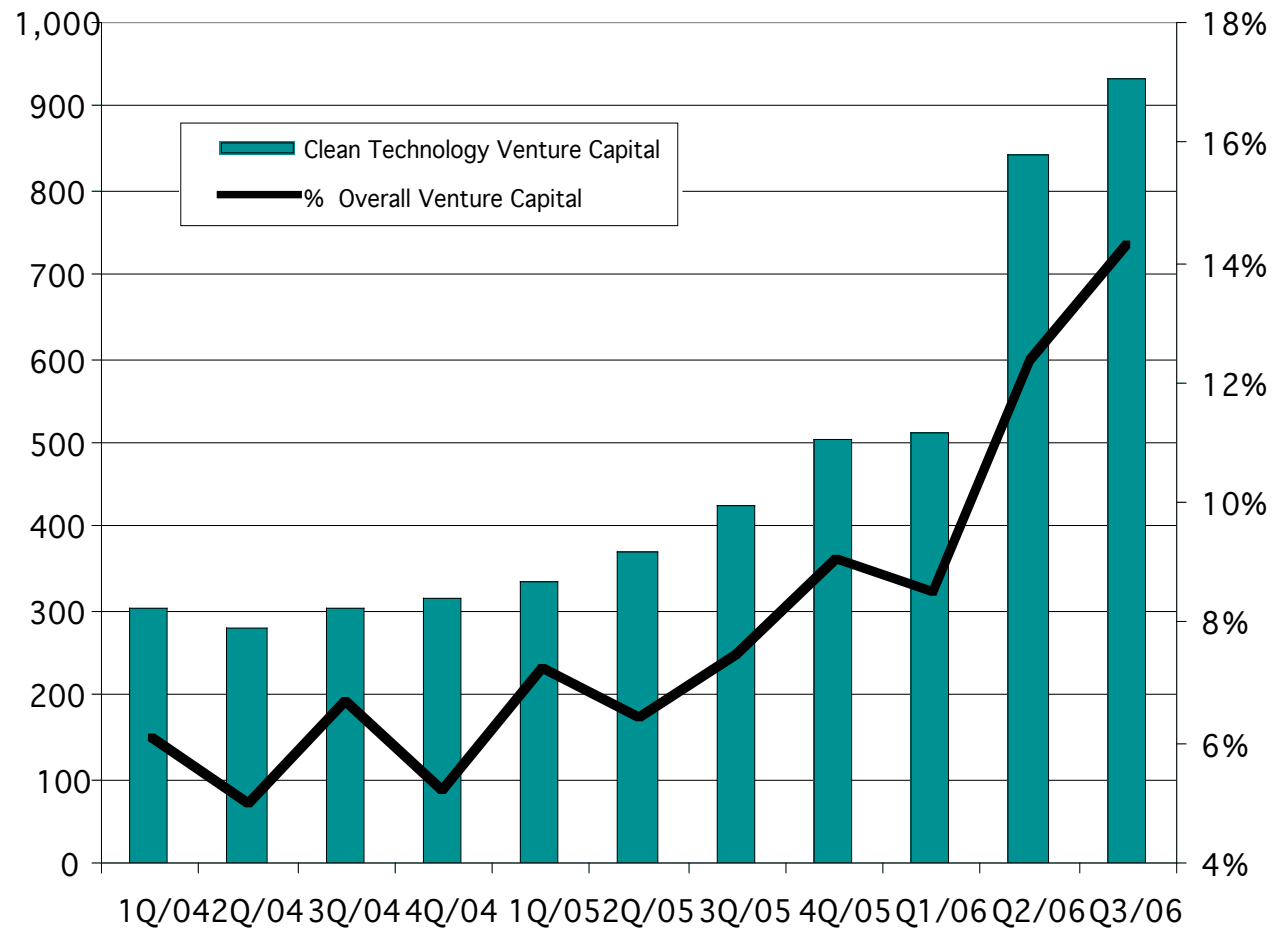


“We believe that reducing greenhouse gases is a win-win.”

“Sustainable companies are just that - sustainable in the long term. “



Venture capital flows to clean technology companies



Source: Cleantech Venture Network





www.WRI.org

